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The research organization serving the ironfounding industry (The British Cast Iron Research Association) was asked to find a way of overcoming this dust hazard.

The research that followed was long and complex, and a method was sought of controlling the small dust particle sizes of 5 microns and less, and preventing these from being inhaled by the operator.

A device was ultimately developed which places a curtain of fast moving air between the work and the operator's face.

This external dust control unit for adapting existing machines is made by Air Control Installations, Ltd., Ruislip, while several companies are making new machines incorporating the device.

The steel castings and refractories industries, through their research organizations, have also developed methods of dealing with the dust hazard. The principle of a fast moving stream of air can be applied in other industries to protect health and improve working conditions.

DSIR

Researches at the British Cast Iron Research Association are helped by grants from the Department of Scientific and Industrial Research, by whom this this notice is issued.

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"Public Relations" and Small Foundries

The Editorials in this JOURNAL of some 30 years ago expressed disgust at the nature of the notepaper and visiting cards used by foundry owners. At that time, they were no better and no worse than those used by the local painter and decorator. There was an immediate change for the better, and to-day, with a few lamentable exceptions, they are of a commendably high order. Not the same praise can be given—by and large—to the exterior appearance of foundry buildings. There is only too-often a lack of any nameplate or signboard. Indeed, quite frequently it is easiest to locate a foundry in a side street by the expensive-looking car parked outside it! A dignified sign of dimensions in keeping with the importance of the establishment is a necessity. Only recently, when visiting a foundry, a quarter-of-an-hour was wasted owing to the absence of any clear indication of its existence in the locality. This is a lack of courtesy due to visitors, and represents one phase of bad "public relations"—as this attitude is more usually described to-day.

Although owners of small foundries are very busy—often over-worked—individuals, they should, in their own interests, pay some regard to appearances, another aspect of public relations. Large concerns pay much attention at considerable expense to this important aspect of their activities. The smaller ones can effect the same results at much less cost. When anything happens, such as an anniversary, the making of a large or interesting casting, the opening of an extension, or installation of a new machine, this can be made the occasion for inviting the Mayor, or perhaps in the case of large cities, the Councillor for the area and a representative of the local paper, to visit the works. Moreover, in these days of public consciousness of the right to object to dust, noise and fume, one's neighbours can be usefully included in such invitations. It all helps to promote good social relationships with neighbours, workpeople, customers and general public alike.

In suggesting that good public relations are assuming increasing importance, it is obviously desirable that their cultivation should not represent a lone effort by the "boss," for he needs the goodwill of every member of his staff. They talk in the clubs and "pubs" and what they say undoubtedly influences public relations. Important news, which always interests employees, is the getting of orders; similarly, a visit by a customer to the works should include meeting the men who try to fulfil his requirements. For the larger concerns, talks to employees by the sales staffs, especially overseas representatives, can be of great value. Their stories—and what salesman is not a good story-teller—can fascinate the actual producers and their repetition all helps with good relations.

THE MARQUESS OF EXETER, K.C.M.G.

Chairman, Birmid Industries, Limited.

Featuring . . . .

THE MARQUESS OF EXETER, K.C.M.G.

THE sixth Marquess of Exeter, K.C.M.G., is a well-known sportsman who, as Lord Burghley, gained an international reputation as a runner and figured with great success in the 1928 Olympic Games. It is, however, his prominent position in the foundry industry that merits notice in this JOURNAL.

He is chairman of the Birmid Industries Group which includes a number of foundries, etc., as follow:—Birmingham Aluminium Casting (1903) Company, Limited; Midland Motor Cylinder Company, Limited; Sterling Metals, Limited; Birmetals, Limited; Pneulec, Limited; Dartmouth Auto Castings, Limited; Birmabright, Limited; Birmidal Developments, Limited; Perry Barr Metal Company, Limited; and the Coneygre Foundry, Limited. The foundries among these comprise one of the largest groups in Europe. He has had an exceptionally busy career. From 1931 to 1943, he was Member of Parliament, and Governor General of Bermuda from 1935 to 1945. As a private secretary to the Parliamentary Secretary to the Ministry of Supply and when in charge of raw materials for tank production during the war, he came in close contact with the foundry industry. Towards the end of the war, he was appointed by the Minister of Aircraft Production, to controller of aircraft repairs and overseas supplies. His great contributions to public service has been acknowledged *inter alia* by the University of St. Andrews, of which he was Rector from 1949 to 1952, by the bestowal of an honorary doctorate of law. He led the United Kingdom Industrial Missions to Pakistan in 1950 and to Burma in 1954.

His recreations are hunting, fishing and shooting and, of course, athletics in general. Since 1936, he has been chairman of the British Olympic Association, he is president of the International Amateur Athletic Federation, vice-president of the International Olympic Committee and is prominently associated with other sporting activities.

Death of Sir John Craig

Sir John Craig, C.B.E., an outstanding figure in the British iron and steel industry, died at his home in Wishaw, Lanarkshire, on February 1 at the age of 82. For nearly 70 years he had been associated with the great concern of Colvilles, of Glasgow, latterly as honorary president, having joined it as an office boy at the age of 13 in 1888. Within 22 years he had become a director and under his guidance it grew to one of the greatest concerns of its kind, with extensive development plans in progress. He was a man of indomitable will, frank and rugged in speech, and a champion of free enterprise in trade. He was also, throughout his career, deeply interested in youthful ambitions, and in providing facilities to help those with initiative and promise. He was chairman of a number of companies in the Colville concern (including the foundries):—Clyde Alloy Steel Company, Limited, Fullwood Foundry Company, Limited, and Colville Constructional Company, Limited, Lanarkshire Steel Company, Limited, Metal-Gas Company, Limited, and Smith & McLean, Limited. He was also a director of the shipbuilding firm of Harland & Wolff, Limited, the Steel Company of Scotland, Limited, the Ardrossan Harbour Company, Limited, the Scottish Mutual Assurance Society, Limited, and other companies, and he was a Deputy Governor of the Bank of Scotland. He had been president both of the National Federation of Iron and Steel Manufacturers and of the Iron and Steel Institute, and for some years was a member of the Council of the Federation of British Industries. He was made a C.B.E. in 1918 and knighted in 1943. In 1951 an Honorary Doctorate of Laws was conferred upon him by Glasgow University.

American Castings Exhibition

American casting producers, recognizing the development possibilities of an exhibition of the sort recently held in Europe (Düsseldorf in September and Sheffield in November, last year) are availing themselves of the opportunity to display products and services in an "Engineered Castings Show," the first industry-wide promotion of its kind to be featured in America. Sponsored by the American Foundrymen's Society, as a product-development project for general industry, the show will be staged in Cincinnati, from May 6 to 10, 1957. Even at this early date, 50 per cent. of the space is booked.

The show will feature castings ranging from one ounce to 50 tons, patterns made of plastics, plaster, metal, wood and resins, modern laboratory-equipment for castings inspection and quality determination, and a wide range of metals and alloys for every method of metal casting. Foundrymen who are to display their products include those working in grey iron, brass and bronze, steel, aluminium, magnesium, zinc-base alloys and malleable iron. Every known method of castings, and their relative engineering advantages, will be demonstrated, including sand casting, shell moulding, centrifugal casting, precision investment casting, permanent moulding.

BIRMINGHAM EXCHANGE AND ENGINEERING CENTRE is to participate in the Leipzig Technical Trade Fair (March 3 to 14), the German Industries Fair, Hannover (April 28 to May 7), and the International Autumn Trade Fair, Vienna (September 8 to 15).

Birmingham and Lancashire Branch Festivities

Groups at the annual social gatherings of the Birmingham and Lancashire branches of the IBF. In the upper picture are the national president, Mr. H. J. V. Williams (left) and Mrs. Williams who assisted the branch president Mr. T. H. Weaver and Mrs. Weaver (accompanied by their daughter) to receive guests at the Botanical Gardens, Edgbaston, Birmingham. In the second picture Mr. and Mrs. Williams are with Mr. W. S. Spenceley (president of the Lancashire branch) and Mrs. Spenceley at their function at the Grand Hotel, Manchester. On their right are Mr. E. H. Beech and Mr. F. W. Nield respectively social and branch secretary.

Refractories in Cupola Practice*

By J. R. Park, F.I.M.

Mr. J. R. Park, F.I.M., was for 20 years chief chemist and metallurgist at Bradley & Foster, Limited, until he retired in 1954. Previously, he held various posts as a chemist and metallurgist with Bolckow, Vaughan & Company, J. Blakeborough & Sons, Limited, and Nuswift Engineering Company, Limited. He is the joint author of papers on the testing of cast-iron shot and grit and heat- and acid-resisting cast irons.

The repair of cupola linings is an ever-present problem in most iron foundries and the Author feels that a re-statement of some of the fundamentals involved will be of interest to foundrymen generally. The paper considers the three types of lining construction and stresses the importance of suitable materials in present-day operation, due to the high percentage of steel scrap employed and the subsequent high temperatures attained. Considerable attention is paid to acid linings, however as the Author states, the same requirements and technical considerations apply to basic and neutral linings. The desired properties of the lining material are discussed, together with the technical and practical considerations involved in the repair and maintenance of the lining.

Normally, three methods are used in lining a cupola or perhaps it would be more correct to say in protecting the cupola shell from being destroyed by heat: —

(1) The cupola is lined with refractory bricks.

(2) A rammed lining is employed, which may be of granular, plastic or semi-plastic material.

(3) The cupola may be water cooled, either by the use of internal water jackets or by external water sprays on the steel shell, for a height of say 5 ft. above the tuyeres, the well and the stack above the water cooling being of brick or rammed lining.

In the modern cupola, often using charges containing high percentages of steel scrap, very high temperatures are reached, a good deal of stress is prevalent and it is therefore desirable to choose a material which will give good service under a variety of conditions. Fig. 1 gives the alumina/silica fusion curve and it will be seen that from the point of resistance to high temperature the refractory should have either a high-silica or high-alumina composition.

Experience has shown that silica bricks are not particularly suitable for cupola linings because they do not satisfactorily resist rapid heating or cooling. As the normal cupola operation involves just that, it means that silica bricks are not usually employed for this purpose. The high-alumina brick, or what is generally known as firebrick, does not suffer from this disability, at least not to anything like the same extent. At the same time, its refractoriness is of a high order and it is therefore the type usually used in the brick lining of cupolas.

Desirable Properties

However, cupola linings have to withstand not only high temperatures, but abrasion and mechanical stresses generally, and the three properties do not always go together. Firebricks tend to lose some of their mechanical strength when heated to high temperatures and the position worsens as the alumina content is increased. Tests show that under a load of 50 lb. per sq. in. a normal firebrick begins to deform at approximately 1,350 deg. C. and this, of course, increases as the temperature elevates. Some authorities consider that the iron-oxide content of the firebricks has a detrimental effect on mechanical strength, as under reducing conditions it can react with the silica in the clay to form a low-melting-point ferrous silicate.

Pressure on bricks in a cupola may develop in various ways. It may be the direct weight of the structure, pressure due to volume changes and pressure due to weight of the charge. Whatever the cause, a firebrick having a wide deformation-range will give the best service.

Abrasion Resistance

A firebrick which resists softening will in general give good abrasion resistance to the movement of the charge. Conversely, however, it is possible that firebricks having a comparatively low refractory value may readily become skin-glazed and in consequence become highly resistant to abrasion.

Volume Changes

The general tendency is for firebricks to contract at high temperatures whilst silica bricks tend to expand. Anything that can be done to stop any form of volume change is all to the good. The firebrick manufacturer should ensure that his bricks are thoroughly " burned " thus stopping any " after-contraction " of the bricks in use. In general, well-burned bricks of the high-alumina type give best service when made from clays which contain enough fluxing impurities to bring about a slight vitrifying action without reducing the refractoriness.

* Reprinted from *Bradley's Magazine*, the house organ of Bradley & Foster, Limited, of which the Author is Editor.

Refractories in Cupola Practice

Corrosion Resistance

All refractory cupola linings of whatever type have to withstand the corrosive effect of slags frequently high in both lime and iron oxide. Well-made firebricks especially of the high-alumina type, will show a good resistance to these conditions.

Resistance to slag corrosion can be tested by cementing to the surface of the brick a ring made of refractory clay, filling this with slag and observing what penetration takes place after heating for some time at cupola temperature.

When lining a cupola with firebricks, care should be taken to see that the joints are as thin as possible; close jointing always promotes durability and avoids the possible penetration of the joints by cupola slag. Corrosion almost invariably starts at the joints, and the wider these are, the quicker the corrosion. The most satisfactory jointing material is a fireclay which contains a large proportion of "burnt" material, or what is known as "grog," for this will have a low contraction factor when heated.

Rammed Linings

The ramming of a cupola lining probably presents more difficulties than bricking with firebricks. It can be carried out by ramming behind a collapsible metal or wooden former, or the lining can be built up layer by layer, allowing an interval of time between each, for drying. To give satisfactory service it is evident that the material should develop sufficient mechanical strength on drying and heating to withstand the arduous conditions of service.

The rammed material when heated should vitrify sufficiently to produce a high skin-strength and have a satisfactory volume stability, as excessive shrinkage will lead to the formation of cracks, thus permitting slag penetration and premature disruption of the lining.

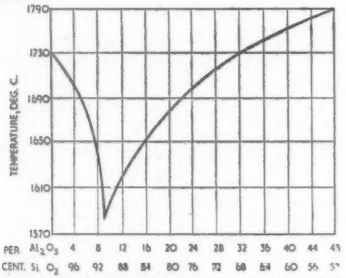


FIG. 1.—*Melting-point diagram of the Al_2O_3/Si O_2 system.*

As distinct from firebricks, most mixtures used for ramming cupola linings are at the high-silica end of the alumina/silica diagram and usually contain more than 90 per cent. silica. They should not be in the eutectic region of 88 to 90 per cent. silica, because that is the range of lowest melting-point and compositions either about 3 per cent. higher or 10 per cent. lower should be selected. The diagram Fig. 1 is that of a pure alumina/silica mixture, impurities tend to move the eutectic point; fluxing materials, such as lime and iron oxide, tending to move it to the right.

In practice, ramming materials are made from naturally occurring high-silica material containing sufficient clay bond or from a mixture of highly silicious crushed rock with just enough fireclay added to give it workability. However it be obtained, it is, as previously stated, very desirable to keep the composition well clear of the eutectic.

There are plenty of excellent materials available which will give ramming mixtures having the necessary characteristics, but most naturally occurring materials require some preparation before being suitable for use. The preparation of synthetic mixtures of silica rock and clay is more easily controlled, but the difficulty here is the same as found with synthetic moulding sands, of obtaining a perfect distribution of the clay bond over the silica grains. One difficulty with a naturally bonded material is that a change of strata at the place of origin may yield a different type of material, and unless a vigilant watch is kept all manner of troubles can result. Whether the material should be finely ground or should contain a proportion of coarse aggregate is a matter of opinion, but for ramming behind a former the Author prefers a somewhat coarse material.

Patching Materials

The number of cupola patching materials is legion and many founders have their own pet mixtures. The basis of most of them is, however, the material known by the all-embracing name of "ganister." The materials sold as "cupola ganister" are very "mixed" both in composition and texture. In the opinion of many cupola operators, the ganister produced in the Sheffield area is amongst the best obtainable. It is made from crushed ganister rock, which is found in the Sheffield district, and mixed with a good-class refractory plastic clay. Good ganisters are, however, made in other districts, but it appears to be an accepted fact that best ganister-making materials are found in association with coal seams. It is not an easy matter to produce any one ganister which will stand up to all the varying conditions of cupola operation. A material which gives good results in one cupola has been known to fail when used in another.

Fundamentally, however, a good synthetic ganister should be made from a high-class silica rock and a good refractory clay. The water content should be only just sufficient to give the necessary plasticity or workability to the material. Too much water, whilst it may make patching somewhat easier for the operator, reduces the mechanical strength of the patch and leads to cracking and consequent slag penetration, despite the expansion which takes place when silica rock is heated to a high temperature.

Patching materials used for repairing cupola linings must have a good green-strength and at the same time must have such properties as will enable them to "stay put," when heated. The ideal method of drying should be by very slow heating, but normally this is not possible with cupola

operation. During heating the following cycle takes place:

(1) Excess or free water is driven off;

(2) Combined water in the clay is then driven off as the temperature is increased;

(3) Sufficient vitrification should take place to make the patch adhere to the rest of the lining.

It will be seen therefore that the conditions are quite severe, so that only first-class materials should be used. As previously stated, excessive moisture or wetness should be avoided.

A good cupola man can do much to make his patching successful by seeing that the walls are cleaned of all adhering slag and that the patching is rammed well home. The use of the modern pressure gun for patching purposes, using finely ground material, has gone a long way to improving patching technique. Unfortunately it is not easy to operate in a small cupola, although it works well in larger ones.

Basic and Neutral Linings

Up to now acid-lined cupolas have been dealt with, but broadly speaking what has been said regarding bricking, ramming and patching applies also to basic-lined cupolas. The type of material used and the slag conditions met with are, however, altogether different, being of a basic nature. The principal materials used for bricking are magnesite bricks, stabilized dolomite bricks, and tar-bonded calcined-dolomite bricks. For bonding, ramming and patching materials, dead-burnt magnesite mixed with a small percentage of bentonite or similar material, to give it green-strength, and various types of ground dolomite powders are employed. One of the problems with basic patching materials is their lack of green-strength or plasticity and this makes it somewhat difficult to get them to adhere to vertical surfaces, but the use of a pressure gun helps matters considerably. The basic materials are only used in the well and melting zone, the upper part of the furnace being lined with conventional fire-bricks. In considering patching materials for basic cupolas, it is felt that there is a field for the development of a better type of material with a higher green-strength and better adherence or "stay-put" properties than any at present available.

In the field of the so-called neutral linings, carbon blocks and high-carbon ramming mixtures appear to give a reasonable life when used for lining cupola wells.

Development of Free-piston Gas Turbine

A new company for the research, development, and improvement of marine propulsion and industrial engines, the Lithgow Power Development Company, Limited, has been formed by Lithgows, Limited, Port Glasgow. As an initial step the new company has obtained a licence from Alan Muntz & Company, Limited, Hounslow (Middx), for the manufacture by the associated companies of Pescara free-piston gasifiers.

Improvement of existing engines, which now include the free-piston gas turbine, may eventually include nuclear energy. The free-piston engine is, in essence, a modified steam turbine driven by hot gases instead of steam. The gasifier replaces the boiler and is a specially designed air-compressor which has no crank-shaft. For a given power space and weight are both reduced, and the absence of vibration may lead to considerable advances in designing the larger types of cargo vessels with the machinery aft.

One of the associated companies, Rankin & Blackmore, Limited, is to construct two sets of exhaust gas-turbine machinery for ships building by Lithgows—an installation of 2,500 s.h.p. for a vessel to the order of Scottish Ore Carriers, Limited, Glasgow, and another of 7,000 s.h.p. for a ship to the order of the Crest Shipping Company, Limited, Nassau, Bahamas.

The directors of the new company are:—Mr. T. Abell (David Rowen & Company, Limited), Mr. A. W. Davis (deputy managing director of the Fairfield Shipbuilding & Engineering Company, Limited), Mr. James Ferrier (chairman of Rankin & Blackmore, Limited), Dr. T. Scott Glover (managing director, of R. Y. Pickering & Company, Limited), and Sir William Lithgow (a director of Lithgows, Limited).

The offices of the new company are, at present, at Eagle Foundry, Greenock, and the directors have appointed Mr. R. J. Tapsell as technical manager.

Expansion of Steel Industry

At the annual dinner of the Sheffield branch of the Institute of British Foundrymen in Sheffield, Sir Archibald Forbes, chairman of the Iron and Steel Board, commenting on the expansion of the steel industry, said the major problem facing the industry to-day was expansion and capacity to meet growing demands and to obtain the raw materials, fuel, equipment, and finances to carry it out. Although steel production had increased by 60 per cent., since the war it had not been able to meet demands. Industry was not solely to blame for this because it had not been able to expand since the war, equipment had been hard to secure, it had suffered from political controversy, and the demand had been under-estimated by both the Government and users. He went on to say that the programme of expansion needed to meet a target of 28,000,000 tons of steel a year in 1962 would require expenditure of £600,000,000 on fixed assets over the next six years; prices should reflect a reasonable return on new capital expenditure otherwise new capital developments will be discouraged. The target figure of 28,000,000 tons for 1962-67, which was 500,000 tons more than the supply from home production last year, might require the imports of iron-ore to be doubled. One of the reasons for the use of indigenous ores was the growing world competition for both ore and shipping.

Sir Peter Roberts, M.P., the Master Cutler, said that the steel industry was being hampered in the export market to suit the administrative convenience of the Civil Service. He had been told by the Board of Trade that high value steels were included in the Export Licensing List "for the administrative convenience of Customs officials at the ports." He intended taking up the matter with the Board of Trade.

OSBORNE & COMPANY, LIMITED, is having a new foundry erected at Clyde Steelworks, Sheffield.

Lloyd's/American Brake Shoe Agreement

Joint Venture in UK to exploit New Production Methods and Techniques

A year ago it was announced that an arrangement had been reached between F. H. Lloyd & Company, Limited, and the American Brake Shoe Company for a joint venture in Great Britain. This has now been implemented by the registration of a new company designated as Lloyds-Brake Shoe, Limited (see page 190 of this issue).

The object of this agreement is to operate foundry processes and techniques which are being successfully and extensively used by the American Brake Shoe Company's engineered-castings and electro-alloy divisions in the USA. The new company is entering into licensing and technical-aid agreements covering the whole range of products which are manufactured by these two divisions of the American company. The field covered represents the outcome of 10 years' research at the American Brake Shoe Company's Research Centre at Mahwah, New Jersey, which is equipped to carry out foundry research on a full production scale.

The factory premises operated by Lloyds (Burton), Limited, were originally built early in the war, and were brought into production by F. H. Lloyd & Commany, Limited, shortly before the end of hostilities in 1945. In 1948, they were acquired by Lloyds (Burton), Limited, which has operated them ever since. The company has developed continuously to keep pace with an ever-growing demand; its products now comprise a wide range of high-duty cast irons, nodular graphite cast irons, and carbon and alloy cast steels. The products covered by the arrangement with the American Brake Shoe Company will be manufactured in addition to the present range of products, and a substantial extension of the factory premises is now under way to permit this development—expected to be complete and in full operation by the end of 1957. Apart from providing specialized facilities necessary for the new processes to be operated, development in hand will approximately double the existing size of the plant, and enable it to manufacture castings in alloy compositions up to 20 tons finished weight. Five members of the technical staff of Lloyds (Burton), Limited, have spent three months with the American concern to study their techniques.

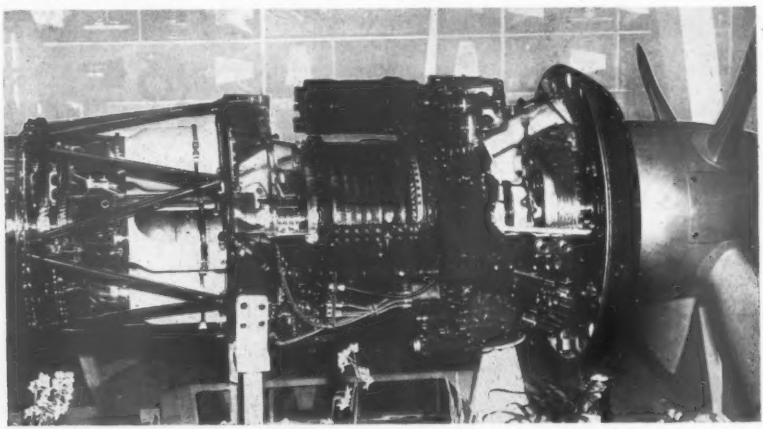
US & UK Companies

The American Brake Shoe Company is one of the largest foundry undertakings in the USA. Mr. W. B. Given, jun., is its chairman and on January 1 this year Mr. Kempton Dunn, as president, became chief executive officer—responsible for all the American Brake Shoe Company's overseas activities. The company's accounts for 1956 showed a 39 per cent. increase in net earnings over those for the previous year to $8,900,000. Reports issued by the company have specifically mentioned tyre moulds and precision castings as mainly the products of research activities. The company controls 60 manufacturing plants, which are widely distributed throughout the USA and are organized into 10 divisions according to product.

F. H. Lloyd & Company, Limited, first started operations in 1878; it has a record of steady growth, particularly since 1939, and apart from substantial expansions at its own premises at Wednesbury and Lloyds (Burton), Limited, it acquired Parker Foundry (1929), Limited (Derby), in 1947.

Board of Trade approval as well as approval from the Treasury for these arrangements between the two companies was obtained in August, 1956. The technical-aid arrangements provide for contribution of practical experience and technique and sole manufacturing rights under various patents by the American Brake Shoe Company, while F. H. Lloyd & Company, Limited, shoulders the burden of finance and management. It is the belief of the boards of both companies that this arrangement opens up a wide and fruitful field of enterprise. The sales areas conceded to the new company comprise the whole of the British Commonwealth and Europe.

MARKHAM & COMPANY, LIMITED, of Chesterfield, are the principal sub-contractors for the £1,000,000 contract for the five largest water turbines to be built in Britain, which has been awarded to Boving & Company, Limited, Kingsway, London. The turbines, each with an output of 140,000 h.p., are to be built between now and 1960. They are for the first instalment of the Kariba Gorge hydro-electric scheme in Rhodesia—a £112,000,000 project which will dam the River Zambesi and make the largest man-made lake in the world. The contract was won in the face of strong competition from Germany, Switzerland, the United States and Canada.



A centre of interest of the "Gas at work" exhibition recently held at the Horticultural Hall, Westminster, was the sectional working Napier "Eland" gas-turbine engine shown. The cut-away model provided an excellent opportunity of appreciating the substantial and complicated series of castings which are incorporated in its construction.

Abstracts from the Düsseldorf Congress Papers*

(*Continued from page 142*)

"CASTABILITY"

"Casting Properties of some Nickel-base and other Nickel-containing Alloys"

By D. R. Wood and J. F. Gregg (UK)

In spite of their importance in foundry practice, the terms "fluidity" and "castability" have only been vaguely defined, and the methods used to evaluate these properties have widely varied. In the investigation reported, the Authors employed the well-known testing procedure employing a spiral casting, in order to make a quantitative measurement of castability in terms of two clearly-defined parameters, "fluidity" and "casting quality." "Fluidity" is defined as the total length of casting run in a standard spiral mould and "casting quality" as the percentage of the spiral length that has satisfactorily reproduced the mould contour.

Nickel-containing alloys are frequently cast in dry-sand moulds but, in view of difficulties involved in drying the moulds, green-sand was used throughout in this investigation. Preliminary tests, however, established that there was no significant difference in fluidity or in casting quality between castings produced by the two methods.

The first part of the paper describes the effects on fluidity and casting quality of small variations in the composition of a nickel/chromium/iron alloy (75 per cent. nickel, 16 per cent. chromium and 7 per cent. iron) having valuable corrosion and heat-resisting properties but limited castability. In a further group of experiments, measurements of castability were made on a wide range of nickel-base alloys including casting nickel (97 per cent. nickel), the Monel alloys, Nimonic alloys, Corronel B and Hastelloy C, and on two heat-resisting steels.

Casting Quality *v.* Fluidity

The investigations established casting quality to be of greater practical significance than fluidity. Fluidity was shown to be relatively insensitive to changes in composition and was related to the amount of superheat. Casting quality, on the other hand, was related to chemical composition rather than to superheat.

While it must be accepted that the factors governing the relationship between flow of molten metal and the quality of the surface produced in a given mould are not fully understood, it is regarded as significant that alloys showing poor casting quality contained chromium and had low silicon-contents. It is considered possible that the casting quality is influenced by the existence of oxide films on the molten alloys studied. The difference in properties between silicon and chromium oxides might explain the striking superiority of high-silicon alloys as compared with low-silicon chromium-containing alloys.

"Hydrodynamic Investigations of Mould-filling Capacity"

By E. Scheil and D. Pohl

Since the fluidity casting spiral has now been standardized, this method, the Authors state, can no longer be used for investigations involving a variation of shape. In order to overcome this deadlock, investigations were carried out on the hydrodynamics of the flow of metals through sand tubes. For this purpose, a very simple flow apparatus was built and used for measuring the velocity of discharge. In the paper, after a short explanation of the rudiments of hydrodynamics, the evaluation of measurements obtained is extensively dealt with. It was found that the discharge apparatus with its measuring tube had itself an appreciable resistance, which will have to be kept as low as possible in future investigations. Taking this resistance into consideration, the measured values in the diagram: log 2—log Re could be represented quite well by a rising straight line approximately within the range of resistance values measured for water flowing through a rough tube. Possible differences between the hydrodynamics of water and of molten metals are discussed.

"New Methods in Thermodynamics and in the Calorimetry of Alloys: Their Application to Iron and Steel"

By W. Oelsen and E. Schümann

The paper describes an improvement in the measurement of heat contents of pure substances and alloys by the method lately developed by Oelsen *et al.* under the name of "quantitative thermal analysis" which combines the classical thermal analysis by means of "cooling curves" (in the Tammann sense) with calorimetric measurements. The paper gives a comparison between the old and the new method of measurement, with corresponding illustrations, and makes it possible to get a more accurate insight of the quantitative thermal-analysis method. It gives partial heat-content curves for pure iron and various alloys, especially cast iron, from melting point to room temperature and discusses the processes which accompany and follow solidification.

* Summaries of selected papers presented at the International Foundry Congress, held last Autumn in Düsseldorf. A number of other papers will be published in the JOURNAL in their entirety and all (in German) are available singly on loan to UK readers on application to the Editor.

Abstracts from the Düsseldorf Congress Papers

"Measurement of the Surface Tension of Cast Iron"

By D. Pohl and E. Scheil

Surface tension of molten metals is a quantity which is of importance for various foundry technical and metallurgical problems, *e.g.* the mould-filling capacity. It is therefore necessary to give attention to the measurement of this value. The Authors state there are two kinds of measurement methods, namely, static and dynamic. By using static methods for measurement on stationary melts, one has to be careful to avoid wetting action between the melt and those parts of the apparatus in contact with it—capillaries, etc. There is also a risk that the values obtained can be influenced by impurities. By using dynamic methods, using oscillating jets, the influences mentioned can be practically neglected since new surfaces are in constant formation. This constant reproduction of surface actually takes place when liquid metal flows into the mould.

The method of measuring the surface tension by means of oscillating jets has so far been used only on melts of low-melting-point metals, but it can also be used successfully for cast iron. Cast iron is poured under suitable hydrostatic pressure through an elliptical nozzle. The jet of pouring metal forms nodes and antinodes which can be photographed in order to find the wavelength. From this and the velocity of discharge it is possible to calculate the surface tension. By using this method, the influence of silicon, phosphorus and sulphur on the surface tension of cast iron melted in ordinary foundry practice has been established. Varying with the iron composition, the surface-tension values are between 2,100 and 900 dyn./cm. Sulphur additions reduce the surface tension; as does phosphorus, but its influence is only about one sixth that of sulphur.

Silicon additions between 0.4 per cent. and 1.5 per cent. cause only a smaller reduction of the surface tension by about 70 dyn./cm. By using cast spirals, a relation between surface-tension and mould-filling capacity was established; the running length of the spiral is shorter if the surface tension is high and *vice versa.* No definite statement about this latter point can however be made as long as the influence on viscosity of the elements accompanying the iron is so far unknown.

"Effect of Treatment of Molten Casting Alloys"

By K. Löhberg

About 12 years ago, Prof. A. Portevin indicated the importance of the formation pattern of primary solidified phases in assessing the "castability" and mechanical properties of casting alloys. He dealt with the question of the appearance of dendritic, polyhedron or globular crystals. As well as the primary crystals, the formation pattern of the eutectic is of decisive influence on the properties mentioned. According to Scheil, eutectics can be normal, degenerate or abnormal.

The paper deals with casting alloys of practical and scientific importance whose common characteristic is that individual phases crystallize in different habits, according to the history of the casting alloy up to the time of pouring. Special attention is given to aluminium/silicon and lead/antimony alloys. In the first group, silicon is the interesting phase, in the second, antimony.

The presence of a small quantity of phosphorus in aluminium/silicon alloys produces a polyhedron crystal habit of the silicon, and a degenerate eutectic (after the concept of Scheil) which can only with difficulty be undercooled. Phosphorus-free alloys however, show primary silicon dendrites and a lamellar eutectic, which can be undercooled and is not degenerate. In both cases, the addition of sodium results in a finer grain of the eutectic which is known as "grain refinement."

In hypereutectic lead/antimony alloys, antimony crystallizes in polyhedral shape, if the alloys contain sulphur. In sulphur-free alloys however, plate-shaped antimony crystals are formed. Crystallization in the one or other habit can be enforced, with constantly reproducable results, by addition of sulphur or sodium.

Phosphorus and Sodium

The effect of additions of phosphorus and sodium is believed to be that, with the metallic components of the alloys, they form the nucleating compounds, aluminium phosphide and lead sulphide respectively, and crystallographically, these are similar to silicon and antimony respectively. It is still undecided whether small crystals of these compounds are already present in the melt or whether their formation *in statu nascendi* provides the nuclei for the crystallization of the respective phases. The effectiveness of the compounds aluminium phosphide and lead sulphide is upset by sodium, possibly as a result of the formation of sodium phosphide or sodium sulphide. In addition, it is thought that stresses on the interfaces between the growing silicon and antimony crystals respectively, and the melt itself, are influenced by way of an increase of the wetting capacity.

In connection with these considerations, attention is drawn to cast iron which according to the preceding treatment of the molten iron, contains graphite either as flake graphite or as spheroidal graphite. Additions causing the spheroidal formation of the graphite (magnesium, cerium) appear to have a disturbing effect on the nuclei which initiate the crystallization of flake graphite. Apparently, iron melts are refined by the above-mentioned additions and thus become capable of undercooling. In conclusion, it is pointed out that phases which are influenced by melt treatment are exclusively non-metals having a metallic fixation component as well as one of like polarity.

Miscellaneous

"Physical Strain of Work on the Man in the Foundry"

By G. Lehmann

The Author begins by saying that it is impossible to separate the concepts of industrial health. *i.e.* protection of employees from overworking, from

that of productivity. Exploiting man himself is always unproductive. With the aid of industrial physiology, the burden of labour can be estimated quantitatively and related to the possibilities of human capability for work. A study of the progression of work, *i.e.* a time-study with accurate observation throughout a working shift, aids in appreciating the early slowing down of effort. The intensity of working, that is to say the amount of energy expended, can be determined exactly by measuring the consumption of oxygen. A healthy man can metabolize a maximum of 4,800 cals. per day when continuously employed. This means that after personal requirements are satisfied, 2,500 cals. are available for the performance of occupational tasks. With this as the maximum, 2,500 cals. may be taken as a normal performance limit.

The extent of muscular fatigue does not become evident at such high expenditure of energy. It arises as a result of oxygen lack in the muscles especially when these are maintained in continuous contraction. Continuous recording of the heart-beat rate gives a good picture of muscular fatigue and the pulse rate can be observed over many hours by means of an electronic recording machine. Additional strains are caused by foundry fumes, gases and dust, and especially noise. Effects due to heat are brought about particularly by radiation. The strain on the body is generally greatest when dealing with weights of medium size, only the task of dressing becomes more exhausting with larger castings. There are few modern foundries in which during mass production of medium-size castings the required work calories to the extent of 2,900 per day are available, especially as this is considerably above the figure for normal performance. Yet, in spite of this high strain, often only a few short rest pauses are introduced into the working time. The total duration of these is as low as 8 per cent. of the working time whereas even in lighter work, 10 to 20 per cent. should be considered as normal. High energy-expenditures are required primarily in machine moulding, transport and shovelling sand.

Possibilities

From available figures, it is possible to work out quantitatively the increase in production which it would be possible to achieve (for instance, by introducing automatic transport of sand) and also the resulting decrease in the strain of work, so that the result of planned measures for rationalization of production processes may be appreciated in advance. In one special case, the conversion from hand moulding to modern machine moulding brought about an increase in performance of 95 per cent. at the same time as a decrease in energy requirements of 45 per cent. If the human performance capacity is used to its maximum, thus regarding manpower as a constant denominator of the production process, then an easing in working conditions automatically results in an increase in production.

Pouring and Noise

The strain involved in pouring is due especially to radiant heat, the fact that moulds are often static, and to the use of old-fashioned equipment. The effect of radiant heat can be considerably reduced by employing screens. The consumption of energy during the dressing of castings with compressed-air hammers is constantly below the permissible limit. Yet, the frequently unfavourable position of the body causes remarkably great postural fatigue which often makes itself evident by a particularly pronounced decrease in performance during the course of the working period, and is recognizable by a corresponding rise in the heart rate. It is postulated that a more suitable arrangement of the castings would considerably diminish the burden on the dresser ; the same applies to the grinding of castings.

Noise arising from the fettling of castings is unpleasant and dangerous, not only because of its intensity but on account of its high frequency. It is reported to be nearly always above the figure at which damage to the auditory part of the ear can occur and certainly always above the figure at which a nervous strain is produced by the occurrence of organic reactions. The intensity of noise can, in many cases, be reduced considerably by introducing suitable building and plant foundations.

"Application of the MTM System in the Planning of Foundrywork"

By J. Eaman (Sweden)

The mere art of being able to turn out castings is no longer the deciding factor for the existence of a foundry. Progress and development have reached a stage where the ability to produce better castings more economically decides "to be or not to be" of the foundry. According to the Author, the foundry industry must concentrate more on developments in production engineering and really make it their job to utilize production-engineering tools that have become available during the last few years. These tools are being used more and more in other branches of industry, and one of these tools is methods/time measurement (MTM).

MTM measures the relationship between method and time thereby giving a direct measurement of productivity. The importance of the knowledge of this relationship can be appreciated more readily when it is realized that an increased effort will, at the most, influence output only from 10 to 20 per cent. On the other hand, a methods improvement will often double output or even increase it by several 100 per cent. Methods/time measurement, the Author states, was developed by a management consulting firm in the United States—Methods Engineering Council, of Pittsburg. This method can be looked upon as a natural link in the chain of developments which started with Taylor's stopwatch time-study procedure, continued by Gilbreth's motion-study and finally improved to the modern work-simplification technique which has been developed particularly in the United States. MTM is a system which is based on Gilbreth's theory that manual operations consist of a relatively small number of different basic motions

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and that every such motion takes a definite time to perform, which is affected by the nature of the motion and the conditions under which it is made. In developing the MTM method, manual jobs were thoroughly examined and, on a basis of accurate and extensive investigations, time values were determined for the various basic motions. When applying the MTM technique for the purpose of determining the time for doing a job, the motions necessary to perform it and their respective time values are recorded and totalled thus giving an accurate time standard for the whole job.

Foundry Application

At the Author's foundry, AB Volvo Pentaverken, this method has been used in connection with work-study engineering for several years.* Experience gained from the application of this method is very promising and gives proof to the fact that systematic work-simplification carried out with the help of MTM can, to a great extent, increase foundry productivity. This foundry uses the MTM time standards as fundamentals for production planning, right from preparation to completed production. The use of MTM in developing methods has proved to be far superior to the conventional tools of work-study engineering.

The setting of all work standards at this foundry is based to-day on MTM time standards. Since the use of MTM for analysing an operation gives a complete clarification of the method used, the time for the operation, determined with the help of the study becomes directly dependent on the method that is used. The work standard thereby becomes just what it should be, a function of the method used. By using predetermined time values for the setting of standards, it becomes unnecessary to use stopwatches and the time-study man is relieved of the disputed duty of rating the performance of an operator. By this system, one of the major causes of dispute between labour and management, has been removed and the way has been cleared for more economical production.

"Future Problems of Research in Foundry Technique"†

By Ove Hoff (Denmark)

The first half of this century is noteworthy for a series of important developments in the field of foundry technique. The greatest progress has been by intensive research which has laid down guiding principles for the developments of foundry technique and which in addition has made possible careful control of practical foundry working. One need only mention the use of alloy cast iron, desulphurization, inoculation and synthetic moulding sand in order to realize the trend of development.

Although there is no doubt that foundry technique and foundry science have made big strides during the last 50 years, there are still foundries to-day, even in leading industrial countries, which operate almost exactly as at the turn of the century. The most extraordinary thing about this fact is that such foundries are often competitive, not only as regards to price, but also as far as quality of production is concerned. One can try to explain this by saying that their ability to compete in the market is limited to a narrow field; in comparison it must be kept in mind that modern foundries of the standard of Ford's at Cleveland are also only competitive in a limited field although, no doubt, the Ford foundry has achieved a high stage of technical development. When considering these facts one is tempted to ask if this enormous technical development is really so essential.

Most of those engaged in this industry have experienced the major difficulties which can suddenly arise in a foundry though working strictly in accordance with modern experience, and aided by all the latest types of control equipment. These difficulties may seriously affect the current production of castings, despite the fact that they have previously been produced satisfactorily in large quantities.

The causes of the trouble may not be established and it may disappear suddenly without explanation. It must be realized that many problems still remain unsolved despite all the progress made to date in the foundry industry. The following survey will attempt to show where knowledge of foundry technique and foundry research stands to-day.

Transition Period

Fifty years ago, founding was the exclusive domain of a master of the foundry craft who had very little physics or metallurgical knowledge to assist his excellent adaptability to foundry problems. The development of foundry technique during this period marks the transition from craftsmanship to science. This transition has been a difficult period, since the scientifically trained foundryman is often inclined to belittle the practical experience and the instincts of a craftsman, when the latter cannot support his opinion by technical formulas. How often has it happened that the practical man resented being told by the foundry technician that the practical man lacked the necessary technical knowledge?

After more than 25 years in the foundry industry and in foundry technical research, the Author's admiration for the non-scientifically trained expert, the craftsman, has increased the more opportunity he has had to study his achievements. In addition, it must be said that present theoretical knowledge is not in a position to explain scientifically all the facts which are met with every day in the foundry. Difficulties still exist even in foundries where the scientifically trained foundry technician has established close working co-operation with the craftsman. This is in many ways connected with the

* Accounts of applications of work simplification as a result of applied time- and motion-study in UK foundries has been reported in FOUNDRY TRADE JOURNAL on numerous occasions—for example, B. BROWN, "Time Control in the Manufacture of Repetitive Castings" 56, 297, 313, 338 (1937) and C. D. POLLARD, "Time and Motion Study in the Foundry" 58, 87 101, 118, 140, 159 (1938).—EDITOR.

† Exchange Paper from the *Dansk Stobemesterforbund* (Danish Founders Association) abstracted by Dr. O. P. Einerl.

problem of training apprentice moulders and coremakers whom the Author designates as craftsmen. It would appear that the skilled man in the foundry is dying out. The present foreman has generally a far better theoretical grounding than previously, he has a knowledge of physics, chemistry and metallurgy, a knowledge of organization, the psychology of handling workmen and planning of work, but sometimes one has the feeling that he is lacking in talent for his craft.

Present Position

Varied experience in the field of foundry technique is finding wide application and is adequately recorded by publications. A large number of foundry technicians with first-class scientific training ensures correct metallurgical investigation at the industry's research institutes, which are equipped with the most modern equipment. Despite all this, technical progress can only just keep abreast of the increasing requirements of customers and of the engineering industry. Some of the problems which arise seem as difficult of solution as they were 50 years ago.

" Heredity " in Pig-iron

Modern science and its achievements are expected to help in solving all these problems. One example of these problems concerns pig-iron. A consensus of opinion existed long ago that different qualities could exist even if the composition of two irons was identical. Modern knowledge shows that the " inherited " properties of pig-iron can be traced back to the production of the iron, in the blast furnace (metal charge, slagging practice, melting temperature, etc.) In the future, it can be expected that charcoal pig-iron will no more be produced, also that the quality of blast-furnace coke will not keep step with the steadily rising performances of blast furnaces.

It must also be expected that the increasing use of scrap will increase the undesirable impurities in pig-iron and it becomes imperative to have a profound knowledge of all those factors which influence the properties of cast iron—factors which cannot be established by the usual methods of chemical analysis. The aim must be to be able to produce any required high-duty cast iron from any raw material by adding the necessary alloying elements, even though this target may not be achieved.

Actually, founders still know very little about the properties of cast iron; they cannot guarantee repetition of structure, but can, if they try hard enough, obtain the desired matrix and graphite distribution. They know very little about wear resistance, and nothing about the optimum composition and structure for wear-resisting diesel cylinders. They are not certain about the influence of dissolved gases, oxide inclusions, non-metallic elements and trace elements.

Furnaces and Melting Operations

When melting with the customary cold-blast cupola, necessary knowledge of the melting procedure itself is lacking, *e.g.* changes of the carbon content during melting. It is known that parts of a charge low in carbon will pick up carbon in the melting process and it has been observed how parts very rich in carbon can lose some of their carbon during melting, but it cannot be said that iron-founders can control the changes in the carbon content during the melting operation.

Opinions also differ about the construction of the cupola. Of the various cupola types which have been developed since Wilkinson, the cupola developed by the Germans Greiner & Erpf may be mentioned, which was later reinvented by the Frenchman Poumay; then there is the Krigar cupola, the " balanced-blast " cupola, etc. If one compares the variety of cupola designs with the fact that a large number of older Krigar cupolas are still in production and working satisfactorily as regards fuel economy, iron temperature and melt quality, the question is justified: Which one is now the correct cupola?

Moulding

In his lectures at the French *Ecole Superieure de Fonderie,* Ronceray stated about 30 years ago that the demand for moulding materials superior to customary moulding sands—*e.g.* in respect of gas permeability—is very great, but the majority of all iron castings are still produced in ordinary sand moulds. Even synthetic sands represent a moulding material of insufficient permeability and strength, because they develop too much gas during pouring operations and because dimensional accuracy is not guaranteed. Although founders have developed oil-bonded core sands, cement sands and sands for the CO_2 Process, the old difficulties have fundamentally remained the same. The only novelty in this field is the Croning shell-moulding process which is however still in its initial stages of development.

In the field of gating practice, founders to-day are still more on the level of the craftsman than on that of the scientist. And how long will it still take before they will be able to master fully the technique of runners and risers and the flow of metal in mould cavities?

Scheme of Work

These few examples illustrate that a considerable demand for research on foundry technique still exists, despite the enormous technical advancement to date. For this reason research workers and technicians should occupy themselves in the first instance with the following problems:—

(*a*) Connection between properties, composition and method of production of pig-iron in order to be able to produce metal with any properties required.

(*b*) The mastery of the uses of cast iron.

(*c*) The control of melting, especially in the cupola, in order to produce any required composition in such a way that undesirable accompanying elements can be removed by alloying and melting technique or can be neutralized by suitable alloy additions.

(*d*) Knowledge of optimum cupola design for

producing maximum iron temperature with minimum fuel consumption. This would dispense with many of the various cupola designs.

(*e*) Development of better moulding materials and moulding methods coupled with directional speed of cooling, better gas-permeability and dimensional accuracy combined with lower cost of moulds. Investigation of the possibilities which may exist by making use of porous sintered metals and ceramic/metal compounds.

(*f*) Further development of moulding and core-making machines and of all mechanical aids in the foundry; better automatic moulding machines for the shell-moulding process.

(*g*) Better knowledge of the flow of metals in mould cavities as a basis for scientific gating technique.

It may be advisable to add that it is not sufficient to carry out research on foundry technique in large works only, but that it is also necessary to publish the results of this research in such simple language that smaller foundries can benefit. More co-operation between foundryman, patternmaker and designer should be achieved.

Finally, in order to achieve better results in all these fields, closer contact and lively exchange of views and experience between research workers and research institutes would be necessary. The creation of a combined international research centre, which would publish its results and organize general co-operation, might open a way for solving these problems as quickly as possible.

Metallic Shotblasting Material and its Testing*

German Proposals Reviewed

The paper gives a detailed account of the factors involved in the somewhat complex subject of classifying and testing the many types of metallic abrasives in use to-day. It suggests that conventional metallurgical testing techniques are not completely adequate for testing all the important characteristics of abrasives and in view of the increasing number of metallic abrasives being developed new testing methods are required.

Classification

A system for subdividing and classifying abrasives is proposed in which letters derived from German technical terms would be used to denote composition, shape, size and hardness. For example, the letters HG from the German word *Hartguss* would be used for chilled iron and the letters ST from the German *stahl* for steel abrasives. Other letters such as K and D are suggested for grit and cut-wire pellets respectively.

Grading Specifications

The whole subject of grading abrasives by sieving is treated very fully for it is important both as a means of specifying commercial grades and as a means of obtaining data from various forms of shot testing. The author gives details of a method which could be used to specify the statistical distribution of particle sizes occurring in a commercial grade. The method outlined is basically the same as that used in the American system for grading shot with the exception that German DIN series of sieves are used. Adverse criticism is made of existing systems of grading abrasives.

Tests of Quality and Efficiency

Tests applicable to metallic abrasives are considered under the headings "Tests on the Abrasive" and "Tests of its Efficiency." The first category are regarded as mainly the concern of the manufacturer in offering a consistent product, *i.e.* chemical composition and metallographic structure, and the paper deals mainly with the tests designed to measure the efficiency of abrasives. Methods of determining physical properties likely to have an influence on the efficiency and life of an abrasive, such as hardness, shape and, in particular, resistance to impact and abrasion are treated very fully. It is suggested that a standardized load of 200 gm. should be adopted for Vickers Pyramid hardness tests on abrasives.

Laboratory methods devised to obtain data on the resistance of abrasives to impact and abrasion are reviewed. Of these only the tests which simulate service conditions in miniature are recommended as satisfactory. A testing machine, of Swiss design, of this type is illustrated. A large section of the paper is devoted to a detailed examination of alternative techniques for operating abrasive testing machines and deriving results which can be correlated with actual service conditions. A further section gives a description of the Almen test strip method of measuring the peening efficiency of abrasives and a way in which the cleaning efficiency of angular grit can be assessed.

Shotblasting Costs

Cost of abrasive is a major factor in shotblasting costs but this it not the whole problem, since the type of abrasive used in a plant governs the wear and tear and can have a profound effect on the productivity. Factors which should be taken into account in deriving shotblasting costs when comparing different abrasives are listed and an example of costs obtained when using chilled iron shot, steel shot, heat-treated chilled-iron shot and cast-steel turnings in a particular plant are quoted. The paper is well illustrated and contains references to previous work on the testing of metallic abrasives.

* Review of a paper read by E. Bickel of Zurich at the Technical House, Essen, and appearing in *Stahl u. Eisen*.

Equipment & Supplies

Refactory Gun

Steel Plant Auxiliaries Limited, Sheffield, announce the production of the B.R.I. Gun under licence from Basic Refractories Incorporated of Ohio, USA. The gun is supplied in two sizes, model A with a capacity of 5 cu. ft., and model A.10 of 10 cu. ft., these guns are for the repair and maintenance of "hot" furnaces whilst in action.

FIG. 1.—*The mobile B.R.I. gun complete with hose and shooting pipe, now available in this country.*

The gun, as in Fig. 1, consists of a pressure hopper with a locking charging lid; an air ejector to sweep the refractory material through the flexible hose and shooting pipe. In this there is a device to turbulently mix the water and refractory, the flow of which is kept even by means of a vibrator. Valves and gauges control both the hopper and ejector pressures, and a pressure relief valve ensures a safety factor. It is claimed that the gun, which is mobile, applies strong patches of cement within a few minutes; conservation of refractory materials effected; maintenance costs being reduced and furnace life extended.

Pamphlets and further details may be obtained from Steel Plant Auxiliaries, Limited, 180, Attercliffe Road, Sheffield 4.

Photomicrography

Carl Zeiss of Western Germany are now producing a new automatic camera microscope, marketed under the name of Ultraphot II; this instrument with wide scientific and industrial applications will shortly be available in this country. The instrument is suitable for visual observation as well as photomicrography and in addition can be used for microprojection on to a ground-glass screen, making it particularly valuable for instructional purposes. For metallurgical work, special wide-angle objectives for survey photography are available.

An outstanding feature of the Ultraphot II is the fully automatic photographic mechanism, which entirely eliminates the difficulties of computing exposures in photomicrography. A single push-button opens the camera shutter and the exposure time is then adjusted automatically to the correct value for the intensity of illumination.

Bright field and dark field methods and phase contrast technique with either trans- or epi-illumination, employing polarized or non-polarized light, may all be readily used. The United Kingdom agents are Degenhardt & Company, 32, Maddox Street, London, W.2.

Photography

Kodak, Limited, announce the introduction of the following chemical and equipment of interest to industrial photographic units. The Kodak hypo clearing agent facilitates the removal of hypo from papers, films and plates, it is claimed that it reduces the washing time to one quarter of that normally required. The cooling unit for processing units operating under tropical conditions has been produced in conjunction with Frigidaire, Limited, and is claimed to maintain the processing unit at 68 deg. F. in room temperatures of up to 90 deg. F. A 35 mm. spiral film processing outfit, model 100, and its companion film drier, are designed for the handling of lengths of perforated or plain film up to 100 ft. Further details may be obtained from Kodak, Limited, Kingsway, London.

Welding Rectifier

British Oxygen Gases, Limited, Bridgewater House, London, S.W.1, announce the introduction of a new composite rectifier for their "Argonarc" welding process, this is known as the ACR.150. It is designed for use with light-gauge materials (with the exception of aluminium and magnesium base alloys) up to ¼ in. thick. It is claimed that this lightweight equipment ensures that the weld crater at the end of the run cools sufficiently slowly to solidify with the least tendency of cracking. The current steps can be varied to give either a rapid or slow decay between 2 to 3½ secs., according to the gauge of the material and the initial welding current employed.

Roller Shutters

Golmet, Limited, of Virginia Park, Caerphilly, have added a new design to their range of roller shutters. The curtain of the door, made of single sheets suitably corrugated and riveted, runs in steel channels on nylon washers and is electro-zinc coated by a newly developed process. Being spring-loaded it can be easily raised or lowered. The fire- and rust-proof door is being manufactured in two standard sizes—7 ft. wide by 6 ft. 8 in. high, and 8 ft. wide by 6 ft. 8 in. high.

Barrier Cream

Four new barrier creams with specific applications are now in production by Rozalex, Limited, Manchester. No. 9, is for use against organic solvents, and plastic materials; No. 10, has been developed for contact with explosive materials; No. 11, is suitable for use with paints, varnishes and heavy oils (this is water soluble and should not be used in wet conditions), and No. 12, is designed for contact with pitch, tar or other photo sensitizers.

Equipment and Supplies

Collapsible Containers

Founders with transport problems concerning small or fragile castings such as tube fittings, typewriter and small aircraft components will be interested in the information that Tracons, Limited, are hiring collapsible toughened-aluminium containers. These are being manufactured in sizes ranging from 24 by 12 by 12 in., to 50 by 24 by 24 in., and are available for purchase or hire. It is claimed that the containers have an effective life of at least six years of constant service, this deriving from the strength of the material employed in its construction and partially from the use of hardened-steel corners.

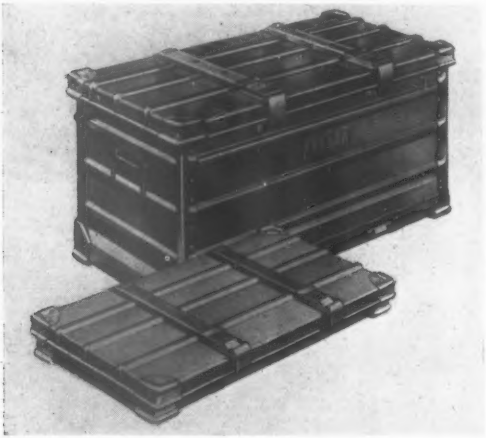


FIG. 2.—*Tracon container, collapsed and erected, showing the reinforced construction, manufactured in Northern Ireland and now available for hire or purchase.*

An unusual feature of the construction is that despite collapsibility they are fabricated without loose parts, obviating the possibility of the loss of any of the sections. In the collapsed state they occupy one fifth of the erected volume—Fig. 2 shows a container erected and collapsed. It is understood that the British Transport Commission regard this type of container with favour owing to its ease in handling and storage, coupled with the low return volume occupied.

The container can be supplied fitted with lightweight wooden shelves facilitating secure packing of small articles. Airtight, waterproof plastic bags are available for use, for example, with components subject to rusting. Further details, specifications, hire and purchase prices and conditions are available from Tracons, Limited, at 5A, Deans Yard, Westminster, London, S.W.1, or Mowden Hall, Darlington, Co. Durham. (Tracons, Limited, is the hire organization for the makers, Light Alloy Construction, Limited, a new subsidiary in Northern Ireland of Thomas Summerson & Sons, Limited.)

IDEAL BOILERS AND RADIATORS, LIMITED, has had plans drawn up for the erection of an extension to the bath foundry at Ideal Works, National Avenue, Hull.

Book Reviews

Iron and Steel Today (second edition), by John Dearden, M.Sc. Published by Oxford University Press, Amen House, Warwick Square, London, E.C.4; price 12s. 6d. net.

In this book the whole field of ferrous-metal production is reviewed, and given adequate treatment in the space of only 270 pages. The first edition has survived two reprints and difficulty must have been experienced when selecting the material to be omitted when preparing the new edition now under review. It is therefore debatable whether the space devoted to the historical aspects of iron and steel manufacture could usefully be extended to include a discussion of raw materials; these have varied tremendously during the past half century and have exerted a profound influence upon the development of the industry. A discussion of ferro-alloys could usefully be included in the book.

All sections of steel production are discussed, though not many open-hearth steelmakers would agree that melting losses amount only to 5 per cent., for scrap quality is probably worse now than at any time in steelmaking history. The substantial contribution of Mushet to the Bessemer process is well known; it would be pleasant to see acknowledgment made of the equally valuable labours of Goransson in the matter of converter air supply.

The section concerned with electric melting is well done and the outline of high-frequency current production and application is very much better than that usually seen in books of this kind. It is surprising to read in this connection that the use of arc furnaces is encouraged in Sheffield by the low cost of power in that area; is not the local interest in alloy steels and tool steels a more potent argument? Not everyone in the steel industry would agree with the author's assessment of the relative values of acid- and basic-open-hearth steels for various purposes; the steady decline in acid-open-hearth output in the face of an expanding market for steel products is a useful criterion, tending to prove that "basic" steel when made correctly is not only suitable but actually used for many purposes formerly regarded as the province of "acid" steel. However, the total tonnage of steel sold exceeds the capacity of acid-open-hearth furnaces in this country!

A useful outline of ironfoundry practice is given, though readers may gain the impression that all sand moulds are two-part only. Ironfounders on the North East Coast have long regarded the High Level bridge at Newcastle-upon-Tyne as an outstanding example of the founders' craft and Stephenson himself would have taken exception to the statement that it was constructed of wrought iron.

Despite these minor criticisms, this is a very useful book, and the illustrations are excellent. The price is very reasonable, and well within the reach of those likely to be interested.

J. B. M.

Electrical Year Book, 1957. Published by Emmott & Company, Limited, 31, King Street West, Manchester, 3; price 3s. 6d. net.

This edition of the "Electrical Year Book" contains a section on the development of thermal-storage heaters, and information is given concerning the regulation of electrical equipment of buildings together with details of electric cables. Certain tests in the installation and maintenance of industrial electrical equipment are also dealt with.

Elimination of a Defect in Leaded Bronze*

Logical Examination of Occurrence, Causes and Cures

A defect associated with leaded bronzes (*e.g.* as illustrated in Fig. 1) consists of numerous irregular cavities, generally filled with greyish powder, which show up after machining. It appears to result from inclusions of slag which do not readily separate from the liquid alloy due to their high density.

Probable or possible causes of these inclusions are:—(1) Substantial oxidation of the lead in the alloy; (2) the presence of silicon in the alloy (the silicon combining with the lead oxide to form heavy fluid silicates); (3) an excess of phosphorus in the bath (which reacts with lead oxide to form phosphates which are again fluid and of high density); and (4) the presence of aluminium (which produces aluminates just as silicon forms silicates).

Bearing these causes in mind, the following points should receive attention:—

Oxidation of Lead

It is first necessary to avoid heavy oxidation of the lead and consequently one should:—

(*a*) Melt as quickly as possible and avoid "stewing" in the furnace.

(*b*) Melt in an atmosphere which is only slightly oxidizing.

(*c*) Since the bath contains lead, protect it from the atmosphere by a good layer of burning charcoal.

(*d*) Do not allow pure lead or alloys containing lead to remain in the muffle ring. Materials containing lead should be added to an already-formed bath. With this in mind, it is best to form a bath of materials free from lead or containing only a small quantity.

(*e*) Reduce to a minimum the period during which the lead remains in the crucible. As far as possible, avoid charging materials containing lead at the beginning of the melt.

It is thus good practice to charge first the virgin metals or lead-free bronze ingots and follow the practice normally used for tin bronze. After skimming and deoxidation, charge the lead or alloy containing lead and continue melting under a cover of burning charcoal. In addition to taking these precautions, the process can be controlled by comparing the lead content of the charge with that of the finished alloy.

Silicon

The presence of silicon in the bath can be avoided by taking the following precautions:—(*a*) Use raw materials which do not contain silicon (preferably under 0.05 per cent.); (*b*) see that all runners, risers and scrap are clean and free from adhering sand; (*c*) do not use crucibles which have been used for other alloys and are badly slagged. Preferably use crucibles especially intended for melting leaded bronze, and (*d*) melt in plumbago crucibles which have not been used too often and brasque (line) them with china clay. This is a subject which can well be discussed with the crucible suppliers as some make special crucibles for handling leaded copper alloys.

Phosphorus

To avoid excessive phosphorus in the alloy:—(*a*) Use raw material and foundry returns free from phosphorus; (*b*) melt in a crucible which has not been used for making phosphor-bronze; (*c*) see that the quantity of phosphor-copper used is only just sufficient for deoxidizing (about 0.10 per cent.) and (*d*) deoxidize with phosphor-copper, preferably before introducing the lead or lead-bearing material, and use a zinc addition for the final deoxidation.

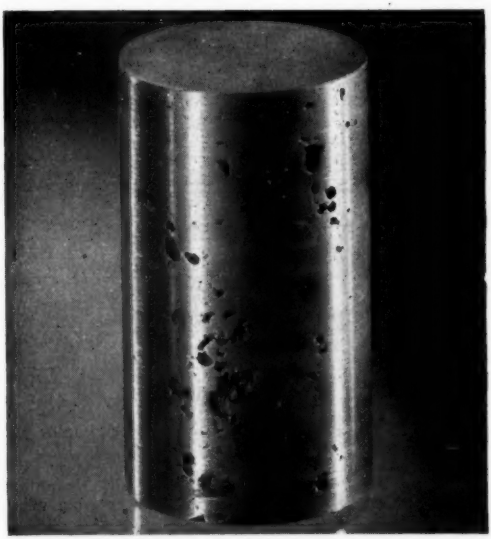
Aluminium

The presence of aluminium in the bath must be carefully avoided by checking the composition of the materials employed. It should be remembered that films of alumina appear in bronzes with aluminium contents above 0.02 per cent.

Elimination of Slag

It is obviously necessary to skim the melt carefully. Moreover, running and risering systems should be contrived so as to prevent slag from entering the mould cavity although this in itself is not a complete cure. For efficient skimming, the following precautions should be taken:—(1)

FIG. 1.—*Specimen 1-in. dia. cut from a leaded-bronze casting and exhibiting greyish powdery slag-inclusions.*



* Extracted from an article "*Elimination d'un Défaut Dans un Bronze au Plomb*," printed in the *Journal des Industries de la Fonderie*, October, 1956.

Elimination of a Defect in Leaded Bronze

When a heavy slag forms on the surface of the bath, it should be skimmed several times during the melt, keeping the bath covered with a layer of burning charcoal, and (2) the bath should not be skimmed immediately after stirring the melt, instead, it should be allowed to settle for three or four min. to let the slag rise.

Thus, there are unfortunately conflicting requirements, *i.e.*, it is necessary to stir the bath to ensure uniform distribution of the lead and, on the other hand, it is essential to allow some time for the slag to rise to the surface before its final skimming —the heavy slag rises but slowly.

Example of Correct Preparation

Taking the foregoing into consideration, the sequence of operations shown in Table I is suggested to avoid the defect illustrated in Fig. 1. It is assumed that the following materials, in suitable proportions, will be used to obtain a specified composition: Bronze ingots free from lead; runners and foundry returns* from leaded-bronze casts, and pure lead or an alloy of high lead-content.

* It should be remembered that use of castings showing the defect illustrated as foundry scrap in subsequent melts will increase the risk of the defect reappearing.

TABLE I.—*Procedure Recommended for Preparing Leaded-bronze Melts.*

(1) Take the crucible to a " red " heat.

(2) Charge small pieces of bronze containing little or no lead at the bottom of the crucible.

(3) Charge the lead-free bronze ingots.

(4) Add to the charge 3 per cent. by weight of the following flux: Silica sand (SiO_2) 3 parts, soda ash 1 part and chalk 1 part.

(5) Melt rapidly in a slightly oxidizing atmosphere.

(6) When this first part of the charge has melted and formed a bath, skim carefully and deoxidize with phosphor-copper (about 0.1 per cent. of the initial charge). The residual phosphorus can be controlled by analysing the first melt and making adjustments so as to avoid any excess of phosphorus in subsequent melts.

(7) Well cover the bath with small-size ignited charcoal.

(8) Progressively introduce into the bath the foundry return scrap and pure lead or high-lead alloy. Do not allow this material to remain in the muffle ring.

(9) Continue melting under very slightly oxidizing conditions (that is, less oxidizing than during the first phase).

(10) Stir the bath well from top to bottom, always maintaining the charcoal cover.

(11) When the temperature has reached about 1,150 deg. C. deoxidize with 0.5 per cent. addition of zinc.

(12) Allow the bath to remain tranquil for from 3 to 5 min. and then skim thoroughly.

(13) Again cover the bath with small-size *ignited* charcoal.

(14) Stir the bath from top to bottom beneath the charcoal layer and prepare for casting. Maintain the layer of ignited charcoal.

Industrial Production Index is Static

Industrial production in 1956 was about equal to that in 1955, according to the index published by the Central Statistical Office. In the closing months of the year it was running at about 2 per cent. below the 1955 peak. Provisional figures estimate output in December at 134-135 (average 1948 = 100). Earlier estimates for November and October have been revised slightly upwards bringing the final quarter average to 141 (2 per cent. less than in the corresponding period of 1955).

On a seasonally adjusted basis there has been no significant change in the general level of production for 22 months. However, there has been a marked change in the pattern of output. In December last car output dropped by 38 per cent. compared with December, 1955, and commercial vehicle output was down by 28 per cent. Output of sulphuric acid rose by 11 per cent. and crude steel by 4 per cent.; electricity generated rose by 8½ per cent.

In general, non-manufacturing industry fared better in 1956 than factory production. Increases in building output and production in the gas, water, and electricity supply industries have offset a fall of about 1½ per cent. in the output of manufacturing industry. In the engineering industries higher output of a wide variety of capital goods has not been enough to offset the big falls in output of cars and a whole range of durable consumer goods.

Back Copies Wanted. For the library of the Metal Institute's laboratories in Holland, back copies of FOUNDRY TRADE JOURNAL for the period from 1940 up to and including 1949 are required, complete or part sequences. Will any reader who can help in this matter write in the first instance to the Editor, stating what is available and on what terms.

Money for ex-POW's (Far East)

Foundrymen who are ex-POW (Far East) and who have changed their addresses without notifying the authorities may find it to their advantage to read what follows:—Money orders representing final shares in the proceeds of Japanese assets realized under Articles 14 and 16 of the Peace Treaty have now been sent to 57,366 former prisoners-of-war and civilian internees of the Japanese or to their immediate relatives. (The individual shares amount to £25 under Article 16 and £5 10s. under Article 14 for former members of the Armed Forces, and to £5 10s. for civilian internees who are eligible under Article 14 but not under Article 16.) The money orders were posted to the last address given by the beneficiaries, but 1,275 which have been returned undelivered cannot be redirected because the people concerned have changed their address without notifying the Ministry. Any ex-prisoner or civilian internee, or an immediate relative of those who have died, who has not yet received his share, or a share under the earlier distributions, should write to the Ministry of Pensions and National Insurance, Thames House South, Millbank, London, S.W.1, as soon as possible and in any event not later than June 30 next.

" Queen Mary's " Record

A three-year-old record has been broken at the Scunthorpe works of the Appleby-Frodingham Steel Company (branch of the United Steel Companies, Limited). The " Queen Mary " furnace broke this record with a total output of 24,980 tons of iron for the four weeks ended January 19. This is 3,970 tons more than the previous best performance, in January, 1954.

Toward the end of last year the furnace hearth was relined and its output capacity has steadily increased since. The combined 10-ft. and 7-ft. Appleby plate mills produced a total of 37,910 tons of finished plates during the same period—an increase of 720 tons on the previous best four-week output achieved in November of last year.

Fourth Melbourne Foundry Convention

A very successful function, the fourth Convention organized by the Australian (Victoria) branch of the Institute of British Foundrymen, was held just before the Olympic Games, from November 13 to 16. It was presided over by Mr. G. D'A. Nash. Apart from the six papers presented, there was a works visit, and on the final evening, the annual banquet. Below, are produced extracts from some of the papers presented:

"Servicing the Moulder"

In a Paper presented by Mr. H. P. Millar of Stanton Ironworks Company, Limited, he included a diagram of a cupboard for moulders' tools which is reproduced in Fig. 1. The Paper was entitled "Servicing the Moulder" and dealt with every aspect of increasing the efficiency of this craftsman. The importance of this was well expressed by Mr. Millar who pointed out that waiting for sand, metal, or tools amounting to half an hour per day meant a loss of nearly three weeks' productive time per annum.

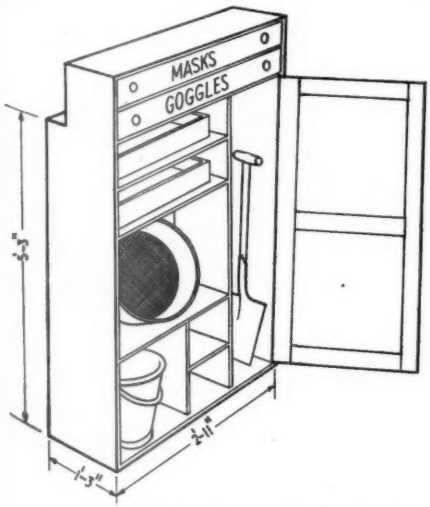


FIG. 1.—*Cupboard for moulder's tools.**

"Castings for South African Gold Production"

The Paper under this title by Mr. H. J. C. Goyns and Mr. J. Steele contained an excellent description of the Rand Gold-mining industry and the interesting castings used for their exploitation and the processing of their products. A wide range of manganese steel, high-carbon steel and grey iron is used.

* In the 1955 Report of the Chief Inspector of Factories, it was stated that this aspect of foundry "housekeeping" had been neglected

"Monolithic Converter Linings"

Monolithic converter linings was the subject of a Paper by Mr. J. Davies. The work covers a lengthy works campaign using bentonite instead of ball-clay. The mixture used contained 50 per cent. of $\frac{1}{4}$-in. quartz; 30 per cent. $\frac{1}{8}$-in. quartz; 14 per cent. silica flour and 6 per cent. bentonite. (A definition of the $\frac{1}{8}$-in. quartz is the crushed product which passes through a $\frac{1}{6}$-in. sieve.) The efficiency factor used by the Author was the consumption of refractory per ton of liquid steel produced. In a campaign lasting about 40 days, 272 heats were blown, producing 393 tons of liquid steel; 19,208 lb. of lining material were used giving an average consumption of 48.8 lb. per ton. In his conclusions, the Author expressed the thought that if a patching material could be produced which would adhere better to the base material, a further advance would be made. His final remark was that it would appear that this type of refractory would be particularly suitable for cupolas.

"Preliminary Survey of the Properties of Investment Cast Plain Carbon Steels"

The Authors of this Paper, Mr. R. H. Dyke and Mr. T. Fitzgerald, have drawn the following conclusions as a result of their research: "The preliminary work reported in this Paper has shown that it is possible to produce good-quality investment-cast plain carbon steels which have similar structures and properties to sand-cast steels of similar composition. In general, hardened-and-tempered investment-cast steels have similar strengths to equivalent wrought steels, but their ductility and impact strengths are lower. The latter can be improved by use of a lower-carbon steel heat-treated to a similar hardness, but it is possible that other mechanical properties of such a steel, such as fatigue strength, would be inferior to those of the wrought steel. The as-cast grain size of investment-cast steels can be reduced by the addition of small percentages of aluminium. This is recommended for investment-cast steels in order to reduce the excessively large grains which may sometimes occur when high pouring- and mould-temperatures are used to produce fine detail. The hardenabilities of the steels are similar to those of the plain carbon wrought steels, and castings with ruling sections up to $\frac{5}{16}$-in. should give satisfactorily hardened structures on oil quenching. Water quenching would probably increase this section thickness to $\frac{1}{2}$- or $\frac{7}{16}$-in. although it must be remembered that this more drastic quenching could give cracking or distortion of complex castings."

"Selection and Design of Equipment for Foundry Mechanization"

Mr. J. E. Waterman, on behalf of the Institute of Australian Foundrymen, New South Wales division, presented the Paper carrying the above caption and before dealing with the types of equip-

Melbourne Foundry Convention

ment for various foundry duties, he submitted, as basic requirements, the following nine points:—(1) Moulding sand is an abrasive material and when tempered it possesses a compressive strength; (2) conditioned sand does not flow freely and before use it must be cool; (3) the physical properties of the sand must be maintained with little variation; adjustments, if required, must be carried out accurately and with a minimum of effort; (4) the mould must be handled carefully during and after closing; (5) each type of casting requires a definite cooling time; (6) moulding boxes are costly and must be handled in such a manner that they are not distorted or damaged on the joint face; (7) mechanical equipment in the foundry is subject to abuse by virtue of surrounding conditions; maintenance may be poor due to labour turnover; (8) all operations should be performed with the minimum amount of labour; skilled labour, when required, should be used to the best advantage, and (9) materials should be mobile and stored above ground level where possible.

The remaining Paper was an account of the works in Australia of Allied Ironfounders (Pty.) Limited (by Mr. G. E. Miller) from which a substantial abstract will be printed in this JOURNAL in the near future.

Gamma Exposure-time Calculator Modification

The British Steel Castings Research Association announce that modifications have been made to the iridium scale of the slide rule (Fig. 1) which they supply for the calculation of exposure times in gamma-radiography.

The change has been made necessary by the decision of the Isotope division of the Atomic Energy Research Establishment to revise the calibration figures for iridium sources which they supply. As from January 1, these sources are being rated at 54 per cent. of their previous value in millicuries.

New slide rules embodying the revised iridium scale are now available from the Association at East Bank Road, Sheffield, 2, and existing users of the calculator can have a corrected slide fitted on payment of a small charge.

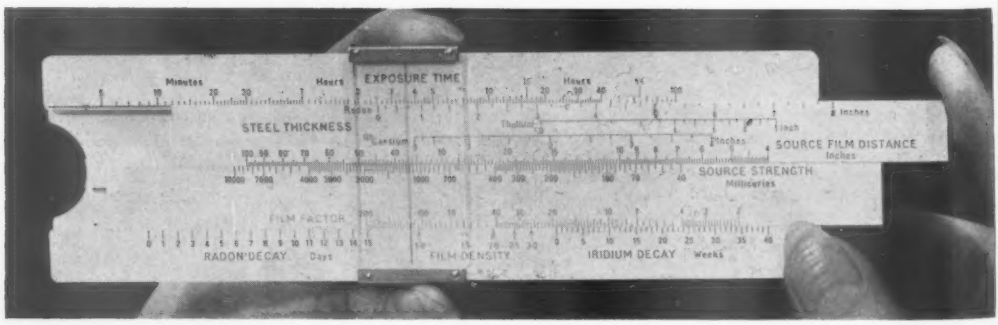
Corrosion Conversazione

The Corrosion Group of the Society of Chemical Industry recently held a Conversazione at Battersea Polytechnic, by permission of the principal, Dr. R. W. West. The exhibition consisted of many stands devoted to corrosion prevention and its technical aspects; two films of instructional interest, and one, starring Donald Duck, dealt lightheartedly with some of the mineral-dressing techniques in a gold mine.

Among those exhibiting was the Ministry of Supply, Armament Research, who recorded progress made in corrosion resistance applied to both ferrous and non-ferrous metals, and results of tropical atmospheric corrosion. The British Iron and Steel Research Association's stand showed an apparatus designed for the study of corrosion of iron and steel in water-supply systems. The Department of Scientific and Industrial Research, chemical research laboratories illustrated results of the use of radio-active isotopes in the detection of surface contamination. The corrosion resistance of cast and wrought titanium in comparison with stainless steel was demonstrated by I.C.I., Limited, the corrosive media being sea water, containing either sand or carborundum particles; and the effect of contact of dissimilar metals in corrosive atmosphere. Pyrene Company, Limited, showed the production of organic and inorganic crystalline coatings on ferrous and non-ferrous metals. Examples of powder-sprayed coatings of metal and plastics, applied to iron and steel products were exhibited by F. W. Berk, Limited, showing the effect of exposure to atmospheric corrosion. Metallic Surfaces Research Laboratories, Limited, showed the heat and corrosion resistance of diffused chromium, in metal surfaces and castings, together with photomicrographs of the diffused layers. The conversazione was attended by many industrial representatives together with members of the academic and teaching profession, and was regarded as fully representative of the work that is being carried out in this field.

PROPOSING the toast of the "City and Trades of Sheffield" at the annual luncheon of the Sheffield branch of the Industrial Life Officers' Association, on January 24, Col. C. R. Hodgson, president of the Sheffield Chamber of Commerce, said that the formation of the European Customs Union would mean "that we shall be part of a home-trade population of roughly 240 millions." He also thought it would mean an absolute revolution in industry and it would be essential for firms to keep up-to-date.

FIG. 1.—*The modified gamma exposure calculator showing the revised calibration figures required by the new rating.*



"Oranges and Lemons"

During the peak of the onslaught by the Luftwaffe on the City of London in 1941, the Church of St. Clement Danes, in the Strand was destroyed by fire, and so perished part of the nursery rhyme "Oranges and Lemons" to lie cracked and broken amidst the ashes and rubble of the second world war.

One of the bells, cast in 1588, fortunately was not seriously damaged, although the intense heat had caused the cannons, or supporting loops to melt, and the tone was affected. The others, including a ring of eight cast in 1693 by Phillip Wightman, were damaged beyond repair.

Restoration of this London landmark is now proceeding and the church is to be dedicated as the Church of the Royal Air Force. Mears & Stainbank, the new trading name for the Whitechapel Bell Foundry which produced the original bells, have cast from the metal of the old peal, a new ring of ten bells, the largest weighing 21¼ cwt., the total weight being 89 cwt. The old 1588 bell is being retained in its original condition, and is being hung as a Sanctus Bell. Fig. 1 shows the bells being delivered to the church on January 23.

At a simple ceremony at the church on Thursday, January 24, the bells were dedicated by the Chaplain in Chief to the Royal Air Force, Canon A. S. Giles. With iron hammers Mr. William and Mr. Douglas Hughes, from the Whitechapel Foundry, played the nursery rhyme "Oranges and Lemons," after this occurred the traditional distribution of oranges and lemons among children of the St. Clement Danes' School.

FIG. 1.—*Workmen delivering the re-cast bells to the church of St. Clement Danes, London.*

MARKHAM & COMPANY, LIMITED, of Chesterfield, are the principal sub-contractors for the £1,000,000 contract, for the five largest water turbines to be built in Britain, which has been awarded to Böving & Company, Limited, Kingsway, London. The turbines, each with an output of 140,000 h.p. are to be built between now and 1960. They are for the first instalment of the Kariba Gorge hydro-electric scheme in Rhodesia—a £112,000,000 project which will dam the River Zambesi and make the largest man-made lake in the world. The contract was won in the face of strong competition from Germany, Switzerland, the United States and Canada.

Law Case

Pneumoconiosis Judgment

In one of the longest opinions ever delivered in the Court of Session, Lord Wheatley, on February 1, made awards totalling £2,506 as damages to three steel workers who contracted pneumoconiosis during their employment with the Carntyne Steel Castings Company, Limited, Moorpark, Renfrew. The cases were the latest to be decided in the long series of actions in the past two years arising from diagnosis of the disease among steel workers and the establishment of a casual connection between it and the inhalation of microscopic dust particles given off during the processes of cleaning and dressing steel castings. It is understood that several scores of similar actions are pending in the Court of Session. In Lord Wheatley's judgment, he awarded damaged against the company as follows:—To Roderick Bowie Cook (65), steel dresser (who sued for £6,000), £750; William Docherty (45), crane driver (£3,000), £1,000; and Norman McCaskill Neilson (49), cleaner and dresser of castings (£4,000), £756.

The actions were based on alleged negligence by the company at common law and on alleged breaches of certain provisions of the Factories Act, 1937, or of certain statutory regulations. The defenders did not admit that the pursuers were suffering from the disease and denied that they had failed in any duties which they owed to the pursuers. After dealing in detail with the processes through which castings were put in the dressing shop, Lord Wheatley said he was satisfied that each process resulted in pulverization of sand which would create the small, dangerous particles of dust, particularly silica dust, which were regarded by the medical witnesses as being dangerous elements when inhaled, but that fact in itself did not entitle the pursuers to succeed. The pursuers contended that dust-extraction plant capable of removing a substantial quantity of dust from swing grinders, such as those in use in the dressing shop, was known in the industry from at the latest 1943, but his Lordship found no support for this contention and held it not proved.

Lord Wheatley said that on the evidence by which he was bound, he held that up until 1951, when Cook and Docherty left the defenders' employment, there was no effective device known to and generally operated in the industry whereby local exhaust ventilation could be fitted to swing grinders to draw off the dust, and even in March, 1954, when Neilson left, such protective devices were not in general use. He was, therefore, unable to hold that during the relevant periods the defenders failed in their common law duty to have such protective devices fitted. The pursuers' case under regulations regarding this aspect of the case also failed. Lord Wheatley said it would appear that respirators were not introduced into steel foundries for general use until after 1951, when the dangers of pneumoconiosis in the industry had been brought home in rather startling fashion by mass radiography. Nonetheless, a respirator known as the Mark IV had been available for use since 1938, and the defenders knew from 1944 of its existence. If, therefore, it was effective—as he held it was—it was obvious folly on the part of the defenders not to issue it to their workers in the dressing shop, even though it could not be said that the issue of such respirators was common practice in the industry at that time.

A SEVEN-STOREY BUILDING at Westgate, Leeds, which is to be the new head office of Brotherton & Company, Limited, industrial chemical manufacturers, has been completed at a cost of £350,000.

Correspondence

MAGNESIUM-ALLOY DEVELOPMENT?

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—The paragraph at the foot of page 68 in the FOUNDRY TRADE JOURNAL dated January 17, headed "Magnesium-alloy Development," makes interesting reading in that it refers to a "new" magnesium/aluminium/zinc alloy of nominal composition aluminium 7.6 per cent., zinc 0.7 per cent., and manganese minimum 0.13 per cent. Whilst some may regard this as "new" in USA, it is only right to point out that the alloy is by no means "new" in Great Britain and, in fact, has been extremely well known to founders and users of castings alike for over twenty years.

Since A.8 alloy (to give it its British name) became DTD.59B in 1935 and later L.121 and L.122, it is true to say that millions of castings have been successfully produced in this material and equally successfully put into service. It is the alloy that was used for practically all aircraft landing wheels before, during and after the war, besides being preferred for a very wide variety of other aircraft and aero-engine parts.

The advantages claimed for the alloy in the USA over AZ.63 (known in England as AZG) are well appreciated in this country and constitute the very reasons why AZG was replaced by A.8 so many years ago. Whilst A.8 alloy is still popular for many castings in this country, other compositions have come forward which are an advance on this material and in many cases have already superseded it.—Yours, etc.

H. MILLWARD,
Technical Superintendent.

Sterling Metals, Limited,
Coventry.
January 29, 1957.

B.R. Exhibition of Brake Components

A trade exhibition of the wide range of components necessary for the British Railways' heavy programme for the fitting of wagons with continuous brakes under the railway modernization plan is to be held at Euston station. It will be held in the Central Offices, room 155, at the station (London, N.W.1), on Monday, February 18 (11 a.m.—4 p.m.), from Tuesday to Friday, 19-22 February inclusive (10 a.m.—4 p.m. each day), and during the corresponding hours from Monday to Friday inclusive in the following week.

The B.R. programme of modernization will grow in momentum throughout 1957, and from 1958 onward will entail the fitting of about 800,000 vehicles. The provision of components to enable this programme to be carried out will mean heavy demands on industry in 1958 and subsequent years, and may require much greater capacity than can be provided by firms normally engaged in railway contracts of this kind. The Commission have, therefore, decided to widen the field of their enquiries, and have arranged this exhibition of the components which will be required—the majority of which are steel, with a few steel and iron castings, and one or two light-alloy and rubber components—for firms who may be interested. Drawings and specifications will be on view. For the convenience of firms' representatives wishing to attend, admission will be by ticket only, obtainable on application to Mr. E. R. Sambridge, chief stores officer's department, B.T.C., room 156, Euston Station, London, N.W.1. The date on which it is desired to attend should be stated, together with an alternative. The exhibition is being arranged solely for manufacturers' representatives and will not be open to the general public.

Manchester College

Significant disclosures as to the future pattern of technological education were made by Mr. K. F. Massey, J.P., M.A., chairman and managing director of B. & S. Massey, Limited, when responding to the toast of "The Visitors" at the annual dinner of the Lancashire branch of the Institute of British Foundrymen, last month. He was referring, in particular, to the great expansion which was to be brought about in the status, size and scope of the Manchester College of Science and Technology.

Mr. Massey said that there were many people in this country who had been conscious for some years that they had not been broadening the knowledge of technology amongst their own people to the extent that they should have been. Just before the war there were 4,500 full-time students at the Technical Colleges in England and yet there were 22,000 in Germany, he said, not including Russia and the USA in comparisons because of their much larger populations. But France, Belgium and even little Holland with 11,000,000 people were able to show better figures than those of the UK. Manchester had now been selected as one of the three centres where there was going to be a drastic increase in the available space for teaching of technology. The old Technical College in Manchester had now received its Royal Charter along with its new name, the Manchester College of Science and Technology. For 130 years of its existence the College had covered 3½ acres; over the next 10 years it was to cover 27 acres. Land had been acquired and the work was to be pursued with all speed.

The idea was not to teach the highly academic sciences in which England stood ahead of everyone, but was to spread the knowledge of technology amongst a very large number of people with the object and the hope that every member of a works' management, from a chargehand upwards, would have at least some diploma. If that seemed to be flying high, Mr. Massey reminded his listeners that it now applied in Switzerland. The Institute, he added, would be called upon to play an ever-increasing part in conjunction with the developments scheduled in Manchester, and he knew they would participate to the full.

Preferential Treatment Deprecated

The Birmingham Chamber of Commerce recently made representations to the Board of Trade urging that firms in the development areas should no longer receive preferential consideration in the placing of Government contracts. It was stated that since 1950, preference for the placing of Government contracts had been given to tenders from the development areas, other considerations such as quality, price, and delivery, being equal. Furthermore, firms in these areas, which quote higher prices, were given the opportunity of meeting competition from the rest of the country. Since the commencement of this policy, there had been a radical change in the employment conditions in the development areas. In reply the Board of Trade said that although unemployment in these areas had dropped considerably in recent years, it was still appreciably above the average for the rest of the country—in November 1956 it was 2.1 per cent. of the insured population compared with a national figure of 1.2 per cent. At a meeting of the general purposes committee of the Chamber of Commerce Council, on January 28, Mr. R. P. S. Bache, chairman, expressed dissatisfaction with the reply from the Board of Trade and said it was not intended to let the matter drop.

Company News

GENERAL ELECTRIC COMPANY, LIMITED—An interim dividend of 4½ per cent. for 1956-57 has been declared on the £18,000,000 ordinary capital as increased from £13,714,680 by a three-for-10 rights issue. A 4⅛ per cent. interim and 9½ per cent. final on the smaller capital made a total of 14 per cent. for the year to March 31, 1956.

VOSPER, LIMITED, shipbuilders, engineers, etc., of Portsmouth—Profits rose sharply in the year to August 31, 1956, and after writing £10,000 (£25,000) off stock, untaxed profit is £103,199 (£46,473). Dividend on the £100,000 ordinary and £25,000 deferred (ranking equally) is raised from the 12½ per cent. of the previous two years to 15 per cent.

SHEEPBRIDGE ENGINEERING, LIMITED—Interim dividend is effectively raised to 5 per cent. from 3½ per cent., allowing for the one-for-two capitalization issue last December. Final dividend for the year ended March 31, 1956, was equivalent to 11¾ per cent. on the present capital. The increase in the interim, the board states, does not foreshadow a larger total distribution for the year.

JOHN BROWN & COMPANY, LIMITED—An interim of 4d. tax free per £1 unit in respect of the year ending March 31, 1957, has been declared. The payment is on the capital as increased by the recent rights and scrip issues and is in accord with the chairman's statement of the intention to bring interim and final dividend into closer relationship. The 1955-56 interim on the smaller capital was 3d. net per unit.

WHITEHEAD IRON & STEEL COMPANY, LIMITED—After providing £195,789 (£193,513) for depreciation and £54,846 (£37,500) for debenture interest, group profits of £1,345,857 compared with £1,227,567. The group's net balance is £671,593 (£610,355), and there is £515,202, (£476,079), available to the parent. An unchanged final dividend of 10 per cent. makes 20 per cent. on the £1,250,000 ordinary for the year ended September 29, 1956.

HADFIELDS, LIMITED—Consolidated profit (subject to audit), before tax and ascertainment of pre-acquisition profits and the minority interests of Millspaugh, Limited, which was acquired during the year, are reported at £1,335,549—Hadfields £923,887 and Millspaugh £411,662. Corresponding figures for 1954-55 were Hadfields £826,663 and Millspaugh £408,419. The final dividend is 5 per cent., making 9 per cent. for the year to September 29, 1956. For the previous year there was a 3½ per cent. interim prior to issues against the Millspaugh acquisition, and a 4 per cent. final on the present capital.

AUSTIN & PICKERSGILL, LIMITED, ship builders and repairers, etc., of Sunderland—Negotiations have been completed by Philip Hill, Higginson & Company, Limited, London & Overseas Freighters, Limited, and Lambert Bros., Limited, for an offer to purchase for cash the entire issued share capital. The offer will be 50s. for each of the 300,000 ordinary £1 shares and par for each of the 300,000 6 per cent. cumulative preference £1 shares. Directors and certain large shareholders have agreed to accept the offer in respect of their holdings which aggregate 230,354 ordinary shares (equivalent to 76.78 per cent. of the equity) and 211.296 preference shares.

JOINT EXPLORATION for natural gas in the Whitby district has been agreed between the B.P. Exploration Company, Limited, and Imperial Chemical Industries, Limited.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BICESTER, February 15—Providing and laying approximately 1,600 yds. of 4-in. cast-iron water mains, for the Ploughley Rural District Council. The Engineer and Surveyor, Waverley House, Bicester. (Deposit £2.)

DURHAM, February 9—Heat engines equipment, including experimental steam plant; heat-treatment workshop equipment; machine and fitting workshop machinery equipment and machinery, etc., for the County Council. Mr. G. H. Metcalfe, director of education, Shire Hall, Durham.

GLOUCESTER, February 11—Provision and laying complete of about 240 yds. of 9-in. dia. spun-iron pumping mains and cross-connecting to existing mains, for the Rural District Council. W. Herbert Bateman & Partners, Chesterfield House, Batheaston, Bath. (Deposit £3 3s.)

HEYWOOD, February 9—Iron castings for the year ending March 31, 1958, for the Borough Council. Mr. A. Middleton, borough engineer and surveyor, Municipal Buildings, Heywood.

INDIA, March 18—Locomotives, boilers, etc., for the Indian Railways. (ESB/30199/56.)

LLANELLY, February 9—Castings for six or 12 months from April 1, for the Town Council. The Borough Surveyor, Town Hall, Llanelly.

MERTHYR TYDFIL February 16—Iron castings, etc., for 12 months from April 1, for the County Borough Council. The Borough Engineer and Surveyor, Town Hall, Merthyr Tydfil.

PAKISTAN, March 4—Universal grinding machine, for the Department of Supply and Development, Government of Pakistan. (ESB/2624/57.)

SHREWSBURY, February 16—Manhole covers, gully grates, and step irons for the year ending March 31, 1958, for the Borough Council. Borough Surveyor, Guildhall, Shrewsbury.

SLOUGH, February 18—Cast-iron manhole covers and frames, and gully grates and frames for 12 months from April 1, for the Borough Council. Mr. E. Gardner Thorp, borough engineer, Town Hall, Slough (Bucks).

TYNEMOUTH, February 18—Cast-iron work, sanitary pipes, etc., for the year ending March 31, 1958, for the Corporation. Mr. D. M. O'Herlihy, borough surveyor, 16, Northumberland Square, North Shields.

Recent Wills

HAYWARD, L. G., chairman and governing director of Hayward & Towell, Limited, iron and steel stockholders, etc., of Peterborough £8,169

WAWN, DOMINIQUE, one of the founders of M. Wawn & Son (Propellers), Limited, and of M. Wawn & Son, consulting engineers, of Sunderland £28,262

MAUNDER, E. A., former traffic manager with the Falmouth Docks & Engineering Company and a member of Falmouth Harbour Commissioners... £1,655

WILEY, F. G., former chairman and managing director of James Wiley & Sons, Limited, bolt and nut manufacturers, etc., of Darlaston, Wednesbury (Staffs) £144,231

HOUGHTON, EDWARD, consultant to the Renishaw Iron Company, Limited, near Sheffield, and blast-furnace manager at the Sheepbridge Coal & Iron Company, Limited, from 1911 to 1941 ... £8,798

TAYLOR, H. G., chairman and managing director of Samuel Taylor & Sons (Brierley Hill), Limited, manufacturers of anchors, chain cables, etc., formerly chairman of B. & S. Massey, Limited, manufacturers of drop-stamping plant, etc., of Manchester, deputy chairman of Lloyds British Testing Company, Limited, Netherton, Dudley (Worcs), and N. Hingley & Sons, Limited, steel rollers, chain makers, etc., of Netherton £256,558

THE AMERICAN SOCIETY FOR METALS, sponsor of the second World Metallurgical Congress, announces that 450 metallurgists, teachers, management, engineering and research executives have already planned to make the overseas trip for the one-week Congress in Chicago, November 2 to 8, and the two-week industrial-plant tour immediately preceding the Congress. All inquiries for further information should be addressed to the American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio. USA.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

763,148. R. W. Taccone, 28, Chautauqua Boulevard, Erie, Pennsylvania, USA.

The invention relates to foundry moulding apparatus for packing sand in a flask against a pattern to produce a mould, and to associated mechanisms. The invention is described with particular reference to the application of the apparatus to the manufacture of pipes, but it may be used for moulds to produce other articles.

763,812. Blackburn & Oliver, Limited, Pemberton, Wigan, Lancs, and I. Pollak, 44, Knowlsey Road, Southport, Lancs.

A method of producing a pre-coated sand for use in formation of shell moulds, cores and the like. A wet sand with a moisture content of 7 to 25 per cent. by weight is intimately mixed with a minor proportion of a finely-divided fusible, solid, thermosetting, phenol-formaldehyde resin of average particle size of from 0.3 to 20 microns. The mixture is heated to a temperature of from 80 to 100 deg. C. to dry it. The resulting produce is then comminuted.

763,841. English Electric Company, Limited, Queen's House, 28, Kingsway, London, W.C.2.

A process for casting on to a base of iron or steel, an adherent body of aluminium, or an aluminium alloy, with copper, iron or silicon. The ferrous surface, when clean, is first sprayed with a layer of aluminium and is then heated. The aluminium or aluminium-alloy body is then cast on to the sprayed surface. The temperature of the junction between the body and the base should be not below 750 deg. C. for a period of at least two minutes, to form an aluminium/iron intermetallic compound at this junction.

763,872. Ford Motor Company, Limited, 88, Regent Street, London, W.1.

A process and apparatus for degassing ferrous metals, during casting. The molten metal is allowed to flow through a restricted throat into an evacuated chamber, whereby it is shattered into discreet droplets. These are allowed to descend by gravity through the evacuated chamber. In the lower portion of the evacuated chamber, the droplets are coalesced into a mass of molten metal. This is then withdrawn through a barometric leg and then discharged into a casting mould. The molten metal is protected from gaseous contamination after it leaves the barometric leg.

763,961. J. J. Bliss, 2207, Penn Avenue South, Minneapolis, Minnesota, USA.

Injection mould process for quickly, easily, and it is claimed, inexpensively forming a sealed connection between two parts having opposed mating surfaces. It employs an alloy composed of lead, tin, cadmium or antimony and at least 40 per cent. of bismuth.

763,970. E. B. Ruscoe, Greensville, Pa., USA, and J. J. Turner, 130, Redditch Road, King's Norton, Birmingham, 30.

Continuous-casting machines of the kind wherein molten metal is poured through a cooling ring, or equivalent means, on to a table which is lowered by power-operated means at a controlled speed. (See also Patent No. 733,913, FOUNDRY TRADE JOURNAL, August 18, 1955).

Forthcoming Events

FEBRUARY 11

Incorporated Plant Engineers

Dundee branch:—Talk by J. Liddle, director of Caledon Shipbuilding and Engineering Company, Limited, on his experiences in shipbuilding, 7.30 p.m., at Mathers Hotel.

Institution of Production Engineers

Sheffield section:—"Continuous Casting," by I. M. D. Halliday, 6.30 p.m., at the Grand Hotel.

Yorkshire section:—"Materials Handling" (and films), 7 p.m., at the Hotel Metropole, Leeds.

FEBRUARY 12

Institution of Production Engineers

Oxford section:—"Material Control," by W. E. Stanley, 7.30 p.m., at the Town Hall.

Birmingham graduate section:—"Properties and some Uses of Titanium," by R. L. Preece, 7 p.m., at the James Watt Memorial Institute, Great Charles Street.

Institute of British Foundrymen

Coventry section:—Annual general meeting, followed by films: "Modern Malleable," "Spotlight on Industry," and "Accidents Don't Happen," 7.30 p.m., at the Coventry Technical College, Room A.5.

Sheffield Metallurgical Association

"Radioactive Isotopes in Industrial Research," by Dr. D. H. Houseman, 7 p.m., at the British Iron and Steel Research Association Laboratories, Hoyle Street, Sheffield.

FEBRUARY 13

Incorporated Plant Engineers

Western branch:—"Effective Use of Semi-skilled Labour," by E. Strong, 7.15 p.m., at the Grand Hotel, Bristol.

Institute of Vitreous Enamellers

Southern section:—"Flame Spraying of Ceramic Coatings for High-temperature Service," by E. D. Teague, 7.15 p.m., at the Howard Hotel, Norfolk Street, London, W.C.2.

Institution of Production Engineers

London graduate section:—"Design and Production of Die-castings in Zinc-base and Aluminium Alloys," by P. A. R. Findlay, 7.15 p.m., at 10, Chesterfield Street, London, W.1.

Institute of British Foundrymen

Burnley section:—"Recent Developments and Current Trends of British Shell-moulding Practice," by D. F. Bailey, 7.30 p.m., at the Burnley Technical College, Ormerod Road.

National Society of Master Patternmakers

Works visit to the Austin Motor Company, Limited, Birmingham.

Manchester Metallurgical Society

"Titanium," by J. W. Rodgers, M.Sc., Ph.D., 6.30 p.m., at the Manchester Room, Central Library, Manchester.

FEBRUARY 14

Incorporated Plant Engineers

Merseyside and N. Wales branch:—"Warehouse Handling, with Particular Reference to Unit Loads," by J. G. Boyne, 7.15 p.m., at the Exchange Hotel, Liverpool.

North-East branch:—"The Plant Engineer and Work-study," by D. F. A. Sinclair, 7 p.m., at Roadway House, Oxford Street, Newcastle-upon-Tyne.

Institution of Production Engineers

Leicester section:—"Solution of Managerial Problems by Operational Research," by S. J. Gielnik, B.Sc.(Econ.), 7 p.m., at the Windsor Room, Bell Hotel.

Institute of British Foundrymen

Beds/Herts section:—"Behaviour of Moulding Sands at High Temperatures," by W. B. Parkes, 7.30 p.m., at W. H. Allen Sons & Company, Limited, Bedford. (Originally the meeting was to have been held at Luton)

Liverpool Metallurgical Society

"Work Hardening and Dislocation Theory," by A. H. Cotterell, B.Sc., Ph.D., 7 p.m., at the Liverpool Engineering Society, 9, The Temple, Dale Street.

FEBRUARY 15

Institution of Mechanical Engineers

"Some Engineering Problems in the Industrial Development of Nuclear Energy," by Sir Claude Gibb, C.B.E., D.Sc., 6 p.m., at Church House, Westminster, S.W.1.

FEBRUARY 16

Institute of British Foundrymen

Bristol and West of England branch:—"Mechanization of Coreshops," by J. Hill, 3 p.m., at Newman, Hender & Company, Limited, Woodchester, Stroud.

News in Brief

THE COUNCIL of the Radio Communication and Electronic Engineering Association has approved the formation of a data processing section.

A TALK by Professor R. Mitsche, on "Recent Developments in Austria in the Field of Metallography" will be given at the Austrian Institute, 28, Rutland Gate, London, S.W.7, on February 25, at 6.30 p.m.

THE AMERICAN BRAKE SHOE COMPANY of New York, and the Ampeo Metal Inc., of Milwaukee have formed the Superston Corporation for the supply of this well known British manganese-bronze alloy in the United States.

A FOUR-PAGE LEAFLET illustrating and describing high-pressure three-throw reciprocating pumps has just been issued by J. & G. Weir, Limited. Copies are obtainable from the company at Holm Foundry, Cathcart, Glasgow, S.4.

FLEMING & FERGUSON, LIMITED, Paisley, have received a further contract for machinery for a 16 in. cutter suction dredge for New Zealand owners, the dredge being designed for the removal of overburden in opencast mining.

FROM FEBRUARY 19 TO 22, British Oxygen Gases, Limited, are holding a Cutting Machine Exhibition at their works in Chester-le-Street, Co. Durham. Machines for cutting deck beams, steel strips, and profiles, will be amongst the equipment on show.

J. H. ROBERTSON & COMPANY, Aintree Road, Perivale, Greenford, Middlesex announce that the Delta special core and wash base, which was detailed in Mr. Brigg's paper "Green-sand Moulding of Large Steel Castings" (FOUNDRY TRADE JOURNAL, January 10) is now being produced and distributed in this country.

LORD HAILSHAM, who succeeds Sir David Eccles as Minister of Education, will now open the sixth Electrical Engineers Exhibition (April 9 to 13) at Earls Court, London. The exhibition will be the largest of its kind occupying more than 330,000 sq. ft., and more than 380 exhibitors are taking part.

THE DERBY EDUCATION COMMITTEE decided last week to recommend to the Town Council that no action be taken on the suggestion that lessons in foundry practice should be held in Derby on Saturday mornings. The suggestion had been made by a Derby firm which hoped to stimulate interest in the work.

THE AMERICAN METAL COMPANY, LIMITED, has made a contribution to the Colorado School of Mines Foundation, Inc., to be used in the School's mining or metallurgy department. The amount is $1,000 and with it goes the request that the money be used in conjunction with mining or non-ferrous metals.

AN ORDER IN COUNCIL has been made, transferring to the Minister of Power the functions relating to iron and steel previously carried out by the Board of Trade. The Order, entitled the Transfer of Functions (Iron and Steel) Order, 1957, (S.I. 1957 No. 95) came into operation on January 25. Copies are available from H.M. Stationery Office, Kingsway, London, W.C.2, price 3d. (by post 5d.).

THE first Lockheed Open University Scholarship has been awarded to Mr. M. R. Grundy, a pupil in the sixth form at Sedbergh School, Yorkshire. The scholarship is to be awarded annually by the Lockheed organization (the Lockheed Hydraulic Brake Company, Limited, and associated companies) and is tenable for three years' study in mechanical sciences at Emmanuel College, Cambridge. It is worth £100 a year.

THE IRON FOUNDRIES DIVISION of Head Wrightson announce that, with effect from February 1, it became a wholly-owned subsidiary company of Head Wrightson & Company, Limited, with the title of: Head Wrightson Iron Foundries Limited. The new company will continue the operations of the Iron Foundries Division and the change in name will in no way affect its friendly relations with either customers or suppliers.

THE CORROSION GROUP of the Society of Chemical Industry is organizing a symposium on the "Corrosion of Metals in Buildings," to be held on March 21, from 9.30 a.m. to 6.0 p.m. at the Institution of Civil Engineers, Great George Street, London, S.W.1. The programme is of interest to some sections of the foundry industry and details can be had from the assistant secretary of the Society, 14, Belgrave Square, London, S.W.1.

THE METAL PHYSICS COMMITTEE of the Institute of Metals is organizing a discussion on the "Metal Physics of Corrosion and Oxidation," to be held at Church House, Great Smith Street, London, S.W.1, on Tuesday, April 30, at 2.30 p.m. The discussion will be opened by Dr. O. Kubaschewski (National Physical Laboratory) and Dr. C. Edeleanu (Tube Investments Research Laboratories). Visitors will be welcome; tickets of admission are not required.

SPEAKING of automation at a forum in Birmingham on January 23, organized by the Midlands branch of the Institute of Sheet Metal Engineering, Dr. N. A. Dudley, head of the Department of Engineering Production at Birmingham University, blamed fanciful speculations for the misgivings of many employees. Much apprehension could be traced to extravagant language such as cybernetics, the robot age, the automatic factory and so on, he said.

A CONGRESS AND EXHIBITION covering Accident Prevention and Factory Hygiene will be held in Düsseldorf from October 17 to 19. The sponsors and organizers of the congress are the Deutsche Gesellschaft für Arbeitsschutz (German society for accident prevention), with the support and co-operation of the various trade associations, and the organization of the exhibition is in the hands of Nordwestdeutsche Ausstellungs-Gesellschaft m.b.H. (Nowea), Düsseldorf.

AT THE ANNUAL DINNER on January 26 of the Wolverhampton and District Engineering Society, Mr. J. C. Milne, managing director of the Electric Construction Company, presented to the Society a president's medallion to mark the long and happy association which both he and his company have maintained with the Society. Mr. J. S. Brotherton, president for 1956-57, is the first wearer of the medallion which incorporates the Wolverhampton coat of arms.

PATERSON HUGHES ENGINEERING COMPANY, LIMITED, of Bedford House, Bedford Street, London, W.C.2, in celebration of their 35th anniversary, held their annual dinner/dance for the staff and works at both Glasgow and London. At both these functions all those employees with over 25 years' service were presented with gold watches. The employee with the longest service, Mr. George Hunter, the Glasgow works fitting-shop foreman, claims equal length of service to that of the chairman.

W. T. HENLEY'S TELEGRAPH WORKS COMPANY, LIMITED, have received a contract from the British Transport Commission, which is valued at approximately £750 000, for the supply, jointing and supervision of installation of 90 route miles of 33 kv 3-core oil-filled cable and pilot/supervisory cable for the Kent Coast electrification scheme. The whole installa-

News in Brief

tion is required for commissioning not later than December 1, 1958, and it is anticipated that cable-laying will commence in April 1957.

WILD-BARFIELD ELECTRIC FURNACES, LIMITED, Elecfurn Works, Otterspool Way, Watford By-pass, Watford, announce the conclusion of an agreement whereby Paul Ferd. Peddinghaus of Gevelsberg, Germany, flame-hardening equipment manufacturers, are appointed sole agents for the sale and service of Wild-Barfield induction-heating equipment in Germany, and Wild-Barfield have the right to use Peddinghaus designs of handling fixtures for use on induction-heating applications where applicable.

ORDERS FOR six cargo motorships; a twin-screw steam tug; three bucket dredgers and a motor coaster have been shared by three Clyde firms. Of the six cargo motorships, three, each of about 1,100 tons d.w., are to be built by James Lamont & Company, Limited, Port Glasgow. The other three, two of about 1,300 tons d.w. and a refrigerated ship of about 1,250 tons d.w., will be built by A. & J. Inglis, Limited, Glasgow. Orders for the other craft have been placed with Fleming & Ferguson, Limited, Paisley.

AT THE ANNUAL MEETING in Birmingham on January 31 of the West Midlands Industrial Development Association, Ald. W. T. Bowen, chairman of Birmingham City Council's Overspill Committee, said that the Birmingham Corporation would soon be establishing a bureau for the assistance of industrialists concerned with re-siting their factories. This service would provide them with details of locations and amenities in the surrounding areas. Mr. B. H. J. Renshaw was elected president of the Association and Mr. J. T. Lynch, chairman.

Mr. F. PICKWORTH, chairman of English Steel Corporation, Limited, bulldozed the first strip of overburden on the 500-acre site for the firm's great development project at Tinsley Park, Sheffield, on Tuesday, January 29. The first building will be a fabricated steel construction 500 by 300 ft. with seven bays for the new spring works which are expected to be completed by 1958. The present spring works at Grimesthorpe will eventually be used for foundry extensions. It was the beginning of a vast project estimated to take 50 years to complete; the initial cost will be £250,000.

THE IRON FOUNDRY at the 82-year-old Leigh, Lancs., works of Harrison, McGregor, & Guest Limited, agricultural machinery manufacturers, is to close. The David Brown organization, which controls the firm, plans to extend the sheet-metal department. Since the company was acquired by them two years ago, considerable progress has been made in modernizing and expanding the works at Leigh, enabling the company not only to continue production of its existing range of harvesting and barn machinery, but also to take over the manufacture of all tillage implements formerly designed and built at the David Brown factory at Meltham.

THE International Congress and Exhibition of Measuring Instrumentation and Automation (Interkama) which will be held in Düsseldorf from November 2 to 10 will, it is claimed, be the first great independent measuring instrumentation event held in Germany. It will be devoted to the technique of the measurement and regulation of electrical and technical-process values. Special provision is being made at the congress for maintenance courses, which will be held throughout the duration of the exhibition. In addition, it is intended that there shall be an instructional display, primarily to furnish young engineers and students with an introduction to techniques of measurement and control.

IN A PAPER on the education and training of technicians and craftsmen in the shipbuilding and engineering industries, Dr. W. S. Cormack, president of Stow College of Engineering, Glasgow, said that many apprentices who embarked on a regular course gave up long before they reached the three-year intermediate stage. Doubtless many attained the status of journeymen in their trade, for that status could be reached by the mere process of serving time, no standard of knowledge or skill being exacted, and without this the designation "craftsman" was inappropriate. Works schools were making a contribution to the production of craftsmen, but too often their instruction ended with the first year of apprenticeship, some even before the apprenticeship had begun. Thereafter the apprentice who did not attend a trades course learnt only what he could pick up from the journeyman in whose charge he was placed, a responsibility which too often was only nominal.

Obituary

The death has occurred of Mr. EWEN H. SMITH, who was chairman and managing director of David Rowan & Company, Limited, marine engineers, Glasgow. He was a past-chairman of the National Association of Marine Engine Builders and was vice-president of the Scottish Engineering Employers' Association.

Mr. ALLEN WEST, founder in 1910 of Allen West & Company, Limited, electrical control and switchgear manufacturers, of Brighton, has died at the age of 79. He was chairman of the Reason Manufacturing Company, Limited, electrical engineers, etc., of Brighton, and president of Allen West (Canada), Limited. Mr. West was a member of the council of the British Electrical and Allied Manufacturers' Association from its inception until a few months ago.

Mr. ARTHUR E. WESTWOOD who was for 58 years Assay Master in Birmingham until his retirement in 1951, died on January 25 at his Edgbaston home. He was 91. Mr. Westwood joined the Assay Office staff in 1882 and was associated with it for 69 years. In 1893 he became a Guardian and joint Master with his father whom he succeeded in 1911. A Liveryman of the Worshipful Company of Goldsmiths and a Freeman of the City of London, he was also the author of several publications and was especially a student of the work of Matthew Boulton.

The death has occurred, at the age of 60, of Mr. ELIJAH HEPWORTH, who was chairman and managing director of Hepworth & Grandage, Limited, engineers, Bradford, and also a director of Associated Engineering Holdings, Limited, the holding company. Mr. Hepworth joined Hepworth & Grandage, Limited, which was founded by his father and two elder brothers in 1907, as an apprentice in 1910, becoming a director in 1924 and sales manager in 1928. He was secretary of the firm from 1933 to 1953, and in 1954 he was made managing director and chairman. When Hepworth & Grandage became a subsidiary of Associated Engineering Holdings in 1947, he was appointed a director of that company.

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Personal

Mr. A. DORMAN and Mr. J. B. PEAT have retired from the board of Dorman Long & Company, Limited.

Mr. A. R. W. LOW, former Minister of State, Board of Trade, has been appointed a director of John Brown & Company, Limited, Clydebank.

Mr. J. T. DAVENPORT, formerly director and general manager of the Alston Foundry Company, Limited, has recently been appointed managing director.

Mr. PETER BAILLIE, who works in the foundry of Smith & Wellstood, Limited, of Bonnybridge, has just published his second novel "Alamein Story." The first was called "Broken Tracks."

Mr. F. W. COOPER, B.SC., (ENG), M.I.MECH.E., M.I.PROD.E., principal of the Chance Technical College, Smethwick, has been appointed education and technical officer to the Institution of Production Engineers.

Mr. E. NEIL CLUTTERBUCK, former technical engineer in the oil-engine division of Rolls-Royce, Limited, Derby, has been appointed assistant professor at the School of Engineering, Washington University, St. Louis, USA.

Mr. C. B. NIXON, who recently retired from the office of chairman of Leyland Motors, Limited, presented the prizes at the annual distribution to Leyland apprentices on January 28. Mr. Walter West, deputy chairman of the company, presided.

The Metals Division of McKechnie Brothers, Limited, Birmingham, announce the following appointments with effect from February 1. Mr. L. HEWITT becomes London area manager (sales) and Mr. H. HOLLINGWORTH, Midland area manager (sales).

Major-General R. E. URQUHART has been appointed a director of Duncan Stewart & Company, Limited, the Glasgow subsidiary of the Davy & United Engineering Company, Limited. He joined Davy & United in an administrative capacity in the autumn of 1955.

Mr. J. GUTHRIE and Mr. J. A. KILBY have been appointed special directors of Colvilles, Limited, Mr. W. GILLIES has been appointed a director of Lanarkshire Steel Company, Limited, and Mr. J. SCOTT managing director of the Fullwood Foundry Company, Limited.

Mr. H. DONALD BOYD has retired from his position of general sales manager for Edgar Allen & Company, Limited, after 50 years' service, but will remain a director of the company. Mr. B. B. GREEN, who has acted as assistant to Mr. BOYD, will succeed him as general sales manager.

Mr. J. L. HEPWORTH and Mr. G. C. HEPWORTH have been appointed joint managing directors of Hepworth & Grandage, Limited, a subsidiary of Associated Engineering Holdings, Limited, following the death of Mr. Elijah Hepworth. Mr. J. H. Mallinson has been appointed sales director.

Mr. GEORGE GUMMER, managing director for 29 years of Gummers Limited, of Rotherham, is not to seek reelection to the board of directors, but he will continue to serve in an advisory capacity. He has been associated with the firm since 1903, and was appointed managing director in 1928. On the death of his father he became chairman and managing director. Mr. Gummer is a past-president of the Northern Brass Founders Employers' Association, and the National Brass Foundry Association.

British & World Shipbuilding

Lloyd's Register Returns for the December Quarter

Steamships and motorships under construction in Great Britain and Northern Ireland at the end of December totalled 328 ships of 2,135,218 tons gross, an increase of 57,242 tons compared with the previous quarter, states Lloyd's Register of shipbuilding returns relating to merchant ships of 100 tons gross and upwards. The total commenced during the year, however, was 35,000 tons smaller than in 1955; and that launched 89,000 tons lower than in 1955. On the other hand vessels completed in 1956 totalled 1,457,000 tons compared with 1,322,000 tons in 1955. The vessels included 85 steamships of 1,076,639 tons and 242 motorships of 1,058,429 tons. In other British Commonwealth countries there were under construction 15 steamships of 40,169 tons and 42 motorships of 105,665 tons. Oil tankers building in Great Britain and Northern Ireland totalled 63 ships of 908,189 tons, an increase of 65,625 tons compared with the previous quarter. The present figure represents 42.5 per cent. of the total tonnage under construction in this country. Vessels building in the world numbered 1,575 of 8,065,068 tons (including four wooden ships of 490 tons), compared with 1,501 of 7,449,310 in the September quarter. The total included 308 steamers of 3,493,262 tons and 1,263 motorships of 4,571,316 tons. Construction in hand in the principal districts of Great Britain and Northern Ireland is indicated in Table I.

TABLE I.—*Vessels Under Construction in Principal Districts of Great Britain and Northern Ireland.*

District.	December 31, 1956.		September 30, 1956.		December 31, 1955.	
	No.	Tons gross.	No.	Tons gross.	No.	Tons gross.
Aberdeen ..	22	31,052	18	20,935	19	21,002
Barrow	3	62,910	4	93,070	4	95,340
Belfast	19	243,687	18	210,050	23	270,130
Bristol	4	2,451	4	2,666	5	3,410
Clyde:						
Glasgow ..	66	455,159	76	447,993	74	469,490
Greenock ..	28	180,955	29	184,421	31	191,277
Dundee ..	6	40,040	5	36,210	6	44,410
Hartlepool ..	7	48,853	7	49,590	8	51,917
Hull	38	21,454	34	19,483	39	20,866
Leith	12	56,000	11	53,160	16	50,654
Liverpool ..	17	160,901	19	156,414	18	154,341
Middlesbrough	14	182,593	14	177,300	12	178,250
Newcastle-upon-Tyne	37	414,750	36	393,251	40	391,385
Southampton ..	4	3,570	4	3,570	4	2,336
Sunderland ..	28	217,696	29	217,406	34	267,330

The sizes of steamships, and motorships in parentheses, under construction in Great Britain and Northern Ireland included the following:—100 to 1,000 tons, 14 steam (93 motor); 1,000 to 2,000 tons, 1 steam (19); 2,000 to 4,000 tons, 1 steam (15); 4,000 to 6,000 tons, 2 steam (17); 6,000 to 8,000 tons, 10 steam (40); 8,000 to 10,000 tons, 10 steam (39); 10,000 to 15,000 tons, 14 steam (19); 15,000 to 20,000 tons, 5 steam (1); 20,000 to 25,000 tons, 23 steam (nil); 25,000 to 30,000 tons, 5 steam (nil).

Of the steam and motor merchant ships under construction throughout the world at the end of December, 4,610,258 (57.2 per cent.) are under the inspection of Lloyd's Register. Of this total, 2,055,970 tons, representing 96.3 per cent. of the tonnage being built there, are under construction in Great Britain and Northern Ireland, while of the tonnage being built abroad, 2,554,288 tons (43.1 per cent.) are to be classed with Lloyd's Register of Shipping.

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Raw Material Markets

Iron and Steel

Although increased imports of iron ore continue, supplies are not equal to the needs of pig-iron producers. The improved deliveries have contributed mainly to the provision of basic pig-iron for the steelworks. The decrease in deliveries from the North African area, however, has affected supplies for the makers of hematite and low-phosphorus iron, and some concern is felt on this score, as stocks held by some of these furnaces are low.

The steelworks maintain their strong demand for pig-iron. Present deliveries appear to be more in keeping with their requirements and their dependence on imported supplies of pig-iron is consequently reduced. For the foundry grades of pig-iron the demand remains about the same as in recent weeks; available tonnages are sufficient to satisfy demands from users for current consumption. Hematite and the low-phosphorus irons are being taken up in fairly good quantities. Some sections of the engineering and speciality foundries are busy, including those supplying castings to machine-tool makers, heavy electrical and power plant engineers, steelworks, and collieries, and with the reduced requirements of other users they are generally able to get the pig-iron they need. In the motor vehicle trade orders for castings are fluctuating; some of the foundries supplying to that trade are a little better placed for work and have reintroduced a five-day working week. The general intake of pig-iron to these foundries, however, shows no appreciable increase, and they appear content to order only those supplies needed to cover current orders.

The demand for light castings remains quiet, but it is hoped that seasonal requirements will shortly bring improved trade. Textile foundries are able to undertake more work, but the jobbing foundries maintain fairly good outputs. The needs of all these foundries, as well as some of the engineering foundries, for high-phosphorus pig-iron are met satisfactorily and, with improved outputs, arrears of orders have been wiped off, apart from high-silicon irons.

Many inquiries for pig-iron continue to be received from abroad, but the tonnage which can be supplied will depend on the quantities which are made available under Board of Trade licences. These will probably consist mainly of the high-phosphorus and refined irons, which, judging by present home demand, can be more easily spared than other grades.

Re-rollers remain well employed, although in some areas demand for their products has fallen, particularly from the motor-car industry in the English Midlands, and also to a lesser extent from other trades, including agricultural implement makers. Small rounds for reinforcing concrete work are in heavy demand.

Deliveries of steel semis from home steelworks continue at an improved rate, but with the amount of usage and the appreciable reduction in deliveries from abroad, stocks on hand have been considerably reduced. Pressure on home steelworks is sustained for the smaller sized billets in 2 in. and 2½ in. square, also for carbon and special quality steels.

Non-ferrous Metals

Weakness in copper continues to manifest itself on both sides of the Atlantic. In London the feature of the market at the end of last week was the lowering of the RST price by £20 to £250 a ton. The price had not changed since the middle of December and the market had discounted the announcement so that it made no immediate impact on the LME quotations. However, it confirms the market's impression of the outlook. In the US, the further reduction of the custom smelters' quotation to 34 cents brought two of the chief producers—Kennecott and Phelps-Dodge—immediately into line and other producers are expected to follow suit. The reverberations of these moves knocked the price of No. 2 scrap down to below 26 cents and the export price to 32½ cents. The end of the downward trend may not be yet. US trade circles are talking the producer price and that of the custom smelters down another cent, with the outside possibility of an eventual reduction to 32 cents. This would be equivalent to £256 a ton, so that its realization is far from unrealistic. However, before that level is reached another cut in the producers' production is expected. Indeed, announcements of further cut-backs in US domestic production may come any day. In any event, the market is dull and featureless on both sides of the Atlantic and no immediate resumption of consumer buying is looked for. On the other hand, it will be interesting to see how much the recent fall can be attributed to "bears," in which case covering operations ought to result in a firming up of the price—however temporary that may prove to be.

Tin prices are little changed. Demand is quietly steady in London and in New York. In London stocks during January fell by 229 to 530 tons. This position is reflected in the maintenance of the backwardation at fully £25 a ton, a feature materially aided by the continued strike at the Butterworth smelter in Malaya. In Indonesia the political situation is worsening and a "show down" is looked for on February 13 when members of the Christian Party have threatened to resign.

Zinc continues to be a scarce commodity in London and on the Continent. US support buying and barter transactions are keeping the market firm and in the States the price is steady at 13½ cents per pound, East St. Louis.

New Company*

An arrangement between F. H. Lloyd & Company, Limited, and the American Brake Shoe Company has resulted in the formation of a new British company—Lloyds-Brake Shoe, Limited. With a capital of £100,000, this company is to take over all the share capital of F. H. Lloyd & Company, Limited's, wholly-owned subsidiary, Lloyds (Burton), Limited, at an agreed valuation (which is in excess of the amount at which this subsidiary stands in the consolidated accounts of F. H. Lloyd & Company, Limited). The capital of the proposed company will consist of 50,000 voting shares and 50,000 non-voting shares. The voting shares will be equally subscribed as between F. H. Lloyd & Company, Limited, and the American Brake Shoe Company, the non-voting shares will all be subscribed for by F. H. Lloyd & Company, Limited. As all shares, non-voting and voting alike, participate equally in profits and assets, the effect of the scheme is that, while control of the new organization is equally divided between F. H. Lloyd & Company, Limited, and the American Brake Shoe Company, F. H. Lloyd & Company, Limited, has a three-quarter share in the equity of the company, while the American Brake Shoe Company has a quarter share.

Directors of the new concern are Mr. W. B. Given, jun. (chairman), Mr. F. N. Lloyd (vice-chairman), Mr. E. Allison, Mr. C. J. Bridge, Mr. W. R. Cooper, Mr. K. Dunn, Mr. A. B. Lloyd, Mr. G. Sammons and Mr. H. P. R. Scott, C.B.E.

* See also page 168 of this issue.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

February 6, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £20 1s. 0d.; Birmingham, £19 13s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £21 18s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £22 2s. 3d.

Scotch Iron.—No. 3 foundry, £23 4s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £24 6s. 6d.; South Zone, £24 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £25 14s. 0d.; South Zone, £25 16s. 6d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. of England (local iron), £22 17s. 6d.; Scotland (Scotch iron), Zone S. 1, £23 4s. 0d.; Sheffield, £24 4s. 6d.; Birmingham, £24 12s. 0d.; Wales (Welsh iron), £22 17s. 6d.

Basic Pig-iron.—£19 3s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £50 0s. 0d. to £51 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £75 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 28s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 12s. 3d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £250 0s. 0d.; 38/40 per cent., £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 14s. 4d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 17s. 4d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £96 0s.0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. to 31s. 0d. per unit; over 6 per cent. C, £94 0s. 0d. to £95 10s. 0d., basis 60 per cent. Cr, scale 31s. 0d. per unit; 2 per cent. C,* 2s. 1½d. per lb. Cr; 1 per cent. C,* 2s. 2d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 6d. to 23s. 6d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £75 0s. 32d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £30 9s. 0d.; tested, 0.08 to 0.25 per cent. C, £31 9s. 0d.; hard (0.41 to 0.60 per cent. C), £32 10s. 6d.; silico-manganese, £41 0s. 0d.; free-cutting, £34 13s. 0d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £38 4s. 6d.; silico-manganese, £41 7s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £36 3s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £37 6s. 0d.; acid, up to 0.25 per cent. C, £40 7s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £39 2s. 0d.; boiler plates (N.-E. Coast), £41 12s. 0d.; floor plates (N.-E. Coast), £40 11s. 0d.; sectional material, N.-E. Coast, £37 11s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested (4-ton lots), £37 18s. 0d.; flats, 5 in. wide and under (4-ton lots), £37 18s. 0d.: hoop and strip, £37 17s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g, £41 6s. 0d.; black sheets (hand mill), 17/20 g., £52 4s. 6d.; galvanized corrugated sheets, 24 g., £65 9s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £64 13s. 9d.; nickel-chrome, £88 15s. 3d.; nickel-chrome-molybdenum, £100 13s. 9d.

NON-FERROUS METALS

Copper.—Cash, £246 10s. 0d. to £247 0s. 0d.; three months, £245 10s. 0d. to £246 0s. 0d.; settlement, £247 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 6⅞d. per lb.; rods, 297s. 9d. per cwt. basis; 20 s.w.g., 330s. 9d. per cwt.

Tin.—Cash, £781 0s. 0d. to £782 0s. 0d.; three months, £761 0s. 0d. to £761 10s. 0d.; settlement, £782 0s. 0d.

Lead (Refined Pig).—First half February, £112 15s. 0d. to £113 0s. 0d.; first half May, £112 0s. 0d. to £112 5s. 0d.

Zinc.—First half February, £101 5s. 0d. to £101 10s. 0d.; first half May, £98 0s. 0d. to £98 5s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £135 5s. 0d.; rolled zinc (boiler plates), all English destinations, £133 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £110.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 1⅜d. per lb.; rods, drawn, 3s. 0¼d.; sheets to 10 w.g., 224s. 3d. per cwt.; wire, 2s. 9¾d.; rolled metal, 224s. 3d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £193; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £242; HTB2 (38 tons), £245; HTB3 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £263; LG3 (86/7/5/2), £272; G1 (88/10/2/½), £325; (88/10/2/1), £318.

Phosphor Bronze.—BS1400, PB1 (AID released), — per ton.

Phosphor Bronze Strip, etc.—Strip, 318s. 6d. per cwt.; sheets to 10 w.g., 313s. 6d. per cwt.; wire, 4s. 2⅛d. per lb.; rods, 3s. 6½d.; tubes, 3s. 4¾d.; chill cast bars: solids 3s. 6½d., cored 3s. 7½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 11½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4¼d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £84 10s. 0d. to £84 15s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.: aluminium bronze (BS1400), AB1, £275; AB2, —. Solder, brazing, BS1945, type 8 (50/50), — per lb., type 9 (54/46), — per lb.

* Average 68-70 per cent.

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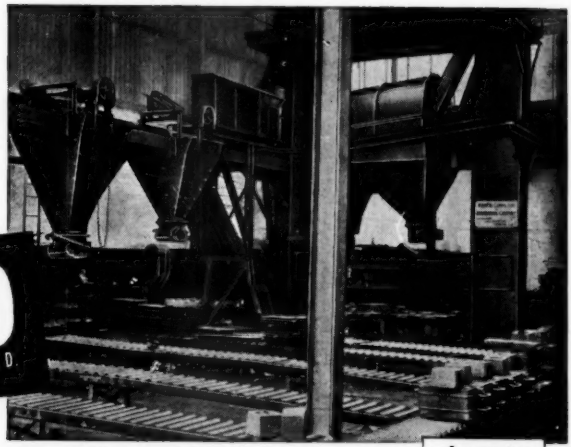

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Imports and Exports of Iron and Steel in December

The following tables, based on Board of Trade returns, gives figures of imports and exports of iron and steel in December. Totals for the years 1956 and 1955 are also included.

Total Exports of Iron and Steel

Destination.	Month ended Dec. 31.	Year ended December 31.	
	1956.	1955.	1956.
	Tons.	Tons.	Tons.
Channel Islands	390	6,038	5,347
Cyprus	1,533	4,526	8,905
Sierra Leone	1,013	9,016	8,765
Gold Coast	2,760	28,896	24,075
Nigeria	4,346	49,881	53,358
Union of South Africa	5,095	65,555	68,047
Rhodesia and Nyasaland	4,696	64,100	76,934
Tanganyika	1,304	17,290	23,045
Kenya	2,524	46,091	42,487
Uganda	115	4,609	4,384
Anglo-Egyptian Sudan	16	17,991	12,460
Mauritius	211	2,376	3,660
Aden	270	7,463	5,149
Bahrein, Qatar, and Trucial States	2,255	12,091	12,014
Kuwait	3,618	4,541	11,373
India	16,701	162,931	291,037
Pakistan	5,749	40,778	60,843
Singapore	4,987	37,485	36,419
Malaya	2,786	25,885	34,455
Ceylon	1,939	18,081	27,729
British North Borneo	1,074	4,248	6,893
Hongkong	9,736	44,591	76,955
Australia	11,181	382,923	207,600
New Zealand	18,809	257,352	181,157
Canada	20,599	133,023	292,390
Jamaica	1,970	17,143	22,395
Trinidad	2,069	46,599	40,844
British Guiana	361	7,511	5,452
Other Commonwealth countries	2,632	24,492	29,450
Eire	3,591	58,665	63,091
Finland	4,359	69,192	60,773
Sweden	5,484	136,998	106,418
Norway	6,715	104,499	89,137
Denmark	8,911	74,641	80,918
Western Germany	216	12,035	8,594
Netherlands	8,446	98,517	92,197
Belgium	2,139	21,485	32,325
France	933	5,754	12,110
Switzerland	1,338	14,590	14,173
Portugal	1,269	12,756	10,928
Spain	1,624	57,128	27,656
Italy	2,438	26,437	18,467
Austria	660	3,300	5,144
Yugoslavia	946	15,099	8,819
Greece	408	8,052	5,815
Turkey	80	8,260	3,865
Netherlands Antilles	165	11,049	7,331
Portuguese East Africa	119	3,370	2,899
Lebanon	17	17,450	5,348
Egypt	—	22,307	35,417
Israel	708	12,264	7,487
Saudi Arabia	1,849	6,866	16,275
Iraq	2,497	40,858	28,868
Iran	2,421	85,104	60,011
Burma	1,746	10,138	9,761
Thailand	1,553	5,046	8,318
Indonesia	357	5,294	9,359
Philippine Republic	351	8,353	7,724
USA	7,468	51,335	69,440
Cuba	856	5,311	9,011
Colombia	178	5,026	4,692
Venezuela	4,488	62,257	66,578
Ecuador	218	3,921	3,979
Peru	1,331	10,443	16,427
Chile	161	987	1,980
Uruguay	1,350	6,802	7,803
Argentina	3,566	52,925	52,757
Other foreign countries	6,483	34,253	79,023
TOTAL	218,178	2,726,273	2,824,540

THE Belgian scientific journal—*La Revue Universille des Mines* which is sponsored by the Siege School Old Students Association, this year celebrates its centenary. The celebrations will take the form of a series of lectures to be held on May 6, 7 and 8.

Total Imports of Iron and Steel

From	Month ended Dec. 31.	Year ended December 31.	
	1956.	1955.	1956.
	Tons.	Tons.	Tons.
Rhodesia and Nyasaland	211	3,758	3,679
Australia	385	79	1,266
Canada	3,325	124,020	59,534
Other Commonwealth countries and Eire	257	24,589	7,780
Soviet Union	31,258	263,650	303,256
Sweden	2,888	33,181	47,529
Norway	9,129	82,545	110,247
Western Germany	11,920	82,543	215,435
Netherlands	3,123	168,591	96,077
Belgium	18,546	210,714	352,743
Luxembourg	2,146	52,681	56,855
France	7,287	314,274	214,418
Italy	887	2,848	13,441
Austria	14,167	129,529	161,921
Japan	2,033	36,635	18,995
USA	15,023	747,701	394,527
Other foreign countries	808	40,721	65,746
TOTAL	123,393	2,318,059	2,123,449
Iron and steel scrap and waste, fit only for the recovery of metal	43,043	1,271,720	982,230

Exports of Iron and Steel, by Products

Product.	Month ended Dec. 31.	Year ended December 31.	
	1956.	1955.	1956.
	Tons.	Tons.	Tons.
Pig-iron	12,961	51,175	143,581
Ferro-colombium (niobium)	20	66	163
Ferro-tungsten	100	587	1,125
Other ferro-alloys	383	3,536	4,453
Ingots, blooms, billets, slabs, sheets, and tinplate bars	149	3,604	1,937
Iron bars, rods, angles, shapes, and sections	123	3,540	2,080
Steel bars, rods, angles, sections, and shapes	41,515	435,646	467,207
Iron plates and sheets	36,865	521,690	468,891
Universal plates	36	9,011	3,241
Steel plates, ⅛ in. and under ¼ in.	444	19,210	10,048
Do., ¼ in. and over	15,646	266,016	221,370
Blacksheets and blackplate	20,696	227,245	233,726
Hoop and strip	4,522	100,993	85,265
Tinplate	21,303	314,075	299,895
Decorated tinplate	431	4,325	5,569
Galvanized sheets	13,271	162,979	157,845
Other (incl. tinned sheets, terneplate, and terneshеets)	801	13,568	13,672
Railway and tramway construction material	12,751	283,681	252,712
Wire rods	2,874	30,007	41,668
Wire	7,817	98,555	95,993
Tubes, pipes, and fittings	61,459	683,046	772,811
Iron castings	183	10,270	2,571
Steel castings	177	1,766	1,966
Forgings	473	3,164	5,136
TOTAL	218,178	2,726,273	2,824,540

LENNOX FOUNDRY, Alexandria, Dumbartonshire, was raided recently and a gunmetal pump casting weighing two cwt. stolen, the casting was almost ready for delivery. In near-by Alexandria works, three solid-copper rollers were stolen from a store. Lennox Foundry is a subsidiary of Drysdale & Company, pump manufacturers, Yoker, Glasgow.